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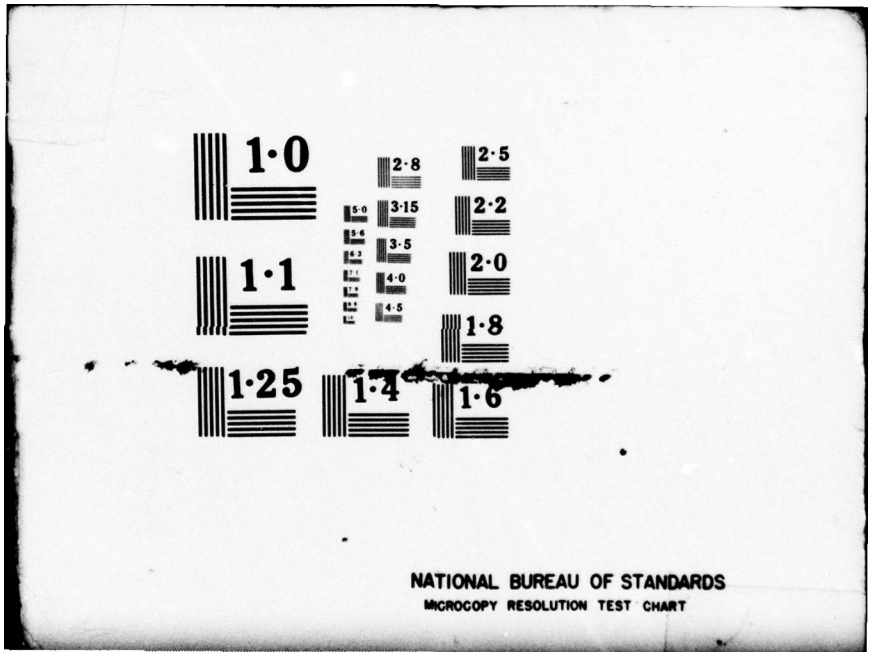
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Report No. FAA-ED-11-1A

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ENGINEERING AND DEVELOPMENT PROGRAM PLAN- CENTRAL FLOW CONTROL SYSTEM

DEPARTMENT OF TRANSPORTATION · UNITED STATES OF AMERICA

AUGUST 1978

Prepared for

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Systems Research & Development Service
Washington, D.C. 20591

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16. Abstract

The Central Flow Control System is being developed as a centralized automated air traffic prediction/management system. It will regulate the flow of traffic to an airport, allow for ground holding delays, and minimize airborne delays resulting in significant fuel savings and the smoothing of traffic flow to coincide with airport capacity.

This Program Plan supersedes Engineering and Development Program Plan number FAA-ED-11-1, ATC Systems Command Center Automation, dated August 1971.

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METRIC CONVERSION FACTORS

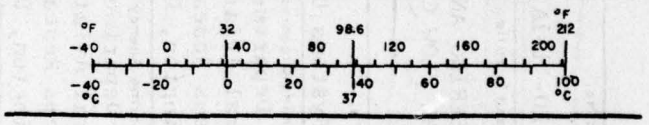
Approximate Conversions to Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.8	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in = 2.54 (exactly). For other exact conversions and more detailed tables, see NBS Misc. Publ. 286, Units of Weights and Measures, Price $2.25, SD Catalog No. C13.10:286.

Approximate Conversions from Metric Measures

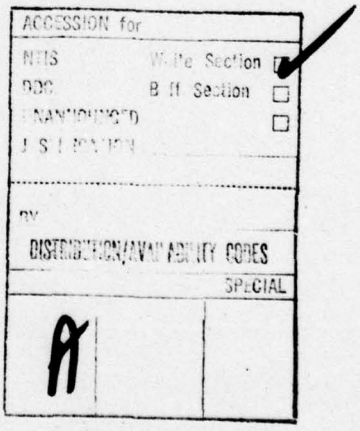
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
ha	hectares (10,000 m^2)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m^3	cubic meters	35	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



FOREWORD

1. PURPOSE. This program plan establishes a plan for managing the acquisition and implementation of an automated central flow control system (CFCS). Responsibilities for the program team are defined with respect to the central flow control system (CFCS) hardware implementation and software development.

2. CONTENTS. The Central Flow Control System (CFCS) is being developed as a centralized automated air traffic prediction/management system. It will regulate the flow of traffic to an airport, allow for ground holding delays, and minimize airborne delays resulting in significant fuel savings and the smoothing of traffic flow to coincide with airport capacity. This document defines functional responsibilities and contains management direction and overall program guidance to all levels within the FAA for the development and implementation of the automated CFCS.



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CHAPTER 1. INTRODUCTION

1. BACKGROUND. The central flow control system (CFCS) has had automation support for some time. Most recently, in January 1972, an improved version of the automation program, named the "airport information retrieval system (AIRS)," was placed in operation by the Transportation Systems Center. AIRS provides terminal arrival delay predictions, flow rates for quota flow (QFLOW) procedures, and fuel advisory departure (FAD) procedure support. The system uses a Digital Equipment Corporation's (DEC) system 10, commercial time-sharing computer with communications interfaces and input/output devices at the air traffic control system command center (ATCSCC), hereafter called SCC, for entry into the facilities master file data bank. The primary data source for the system is the official airline guide (OAG), published by the R. H. Donnelly Corporation. The need for a substantial improvement to the automation support of the CFCS has been recognized for a number of reasons. Marked increases in air traffic have occurred within the last few years. Therefore, in order to avert congestion problems before they surface, there is a necessity for a fast, dependable, and accurate CFC system that is predictive rather than reactionary. Also, energy conservation requirements for aircraft are rapidly placing more stringent demands on the FAA to optimize aircraft movement. CFC automation focuses on minimizing en route delays. An additional consideration is improved ATC system safety.

2. SCOPE AND PURPOSE.

a. This program plan for the CFCS will serve as the basic document for the following functions:

(1) To describe the program responsibility and authority by both program organization and agency organization.

(2) To define the program activities against which progress is to be measured.

(3) To identify the key offices and functions involved in carrying out the program.

(4) To form the planning basis for resource commitment to this effort.

b. The organization of this document is keyed around phases in the life cycle of the program. Chapter 2 will describe the definition and assessment phase including all the required activities leading to the beginning of CFCS development. Chapter 3 will describe the development and implementation phase which includes all the necessary activities leading to a successful commissioning

of the CFCS. Chapter 4 will describe the operations and maintenance phase including all of the activities involved with the cost of system ownership. Finally, Chapter 5 will present the detailed schedules and reporting mechanisms required for successful management visibility and control of the CFCS program.

c. This plan is intended to specifically define the responsibilities of various participants during the implementation of the CFC automation program. Other FAA documents that define management responsibilities are:

(1) Handbook 1100.1, FAA Organization - Policies and Standards, December 23, 1966.

(2) Handbook 1100.2, FAA Organization - FAA Headquarters, May 26, 1967.

(3) Order 1100.121A, Management of Air Traffic Control Automation Systems, July 6, 1972.

(4) Order 1100.127A, Airway Facilities Sector Configuration, November 7, 1973.

(5)Order 1100.134A, Maintenance of National Airspace System Automation Subsystems, June 27, 1973.

(6) Handbook 1800.1, National Airspace System (NAS) Management, August 1, 1967.

(7) Order 1800.8D, National Airspace System Configuration Management, March 26, 1975.

(8) Order 1800.30, Development of Logistic Support for FAA Facilities and Equipment, July 12, 1972.

(9) Handbook SM 1800.8, Systems Maintenance Service Planning, Programming, and Budgeting Procedures - Internal, June 27, 1967.

3. REFERENCES AND AUTHORITY.

a. The automation of the CFCS is being implemented in conformance with the agency review board decision dated April 1976 which followed the DOT transportation system acquisition review council (TSARC) approval of the program.

b. Further guidance and responsibilities for the conduct of this program are provided in the following documents:

(1) Acquisition Paper for CFCS, April 1976.

(2) Selection Plan for Central Flow Control Facility Operational Software, April 1976.

(3) CPFS, Vol. I - Introduction to Specification Series, System Overview, FAA-RD-76-157, I, September 1976.

(4) CPFS, Vol. II - Application Program Specifications, FAA-RD-76-157, II, September 1976.

(5) CPFS, Vol. III - Offline Support Subsystem Specification, FAA-RD-76-157, III, September 1976

(6) CPFS, Vol. IV - Data Base Subsystem Specification, FAA-RD-76-157, IV, September 1976.

(7) CPFS, Vol. V - Executive Subsystem Specification, FAA-RD-76-157, V, September 1976.

(8)Central Flow Control Software System Analysis, Vol. I, Executive Software Study, FAA-RD-76-160-I, July 1976.

(9) Central Flow Control Software System Analysis, Vol. II., Data Base Software Study, FAA-RD-76-160, II, July 1976.

(10) A Computer Program Functional Design of the Simulation Subsystem of an Automated Central Flow Control System, FAA-RD-76-144, August 1976.

(11) FEDSIM Project Memorandum, MV-046-055-DOT Central Flow Control Support for FAA, September, 1976.

(12) Statement of Requirements, AAT-1 letter, December 24, 1975.

(13) Central Flow Control Automation Program Cost Benefit Analysis, September, 1976.

c. Additional policy guidance may be found in the following:

(1) Order 1800.30	Development of Logistic Support for FAA Facilities and Equipment, dated July 12, 1972
(2) Order 2700.13	Financial Reporting Procedures for National Airspace System Program Office (NASPO), dated May 5, 1969
(3) Order 4560.1	Initial Provisioning for Support of Facilities, dated July 29, 1969

(4)	Order 4620.1	Scheduled Overhaul of Ground Facilities Equipment, dated December 1, 1966
(5)	Order 4620.3B	Initial Support for New or Modified Equipment, dated November 8, 1971
(6)	Order 4630.2	Standard Allowances of Supplies and Working Equipment for National Airspace Facilities, dated September 26, 1969
(7)	Order 4650.17A	Guide for Non-FAA Activities which Receive Supply Support and Service from the FAA Aeronautical Center (FAA Depot), dated February 2, 1972
(8)	Order 6200.4A	Test Equipment Management, dated October 22, 1970
(9)	Handbook 4250.9	Field Inventory Management and Replenishment, dated June 22, 1966
(10)	Specification FAA-G-1210c	Guide for Range of Provisioning Technical Documentation Required for the Initial Provisioning Process
(11)	Order 1320.37A	Contractor Developed Equipment Instruction Books, dated May 25, 1973
(12)	Order 6000.19	Use of Specifications FAA-D-2494/1 and 2494/2 Instruction Book Manuscript Technical: Equipment and Systems Requirements, dated November 9, 1972
(13)	Handbook 4650.2	Facility Equipment Records, dated June 15, 1965
(14)	Handbook 4660.1	Real Property, dated February 1969

(15)	Handbook 4650.7	Management of Project Materiel, dated May 3, 1968
(16)	Handbook 4800.2	Utilization and Disposal of Excess and Surplus Personal Property, dated May 8, 1968

4.-20. RESERVED.

CHAPTER 2. DEFINITION AND ASSESSMENT PHASE

21. INTRODUCTION. This phase involves the following:

a. Definition of the application to the level required for program authorization.

b. The formulation and documentation of the development objectives which form the basis for CFCS.

c. A presentation of the proposed approach to satisfying the objectives through identification of the major activities, products, and schedules.

d. Identification of the responsibilities of the various supporting FAA organizations.

e. The overall approach to logistics support.

f. The required funding and staffing levels.

g. The methods of reporting and control to be used during this phase of the program activity.

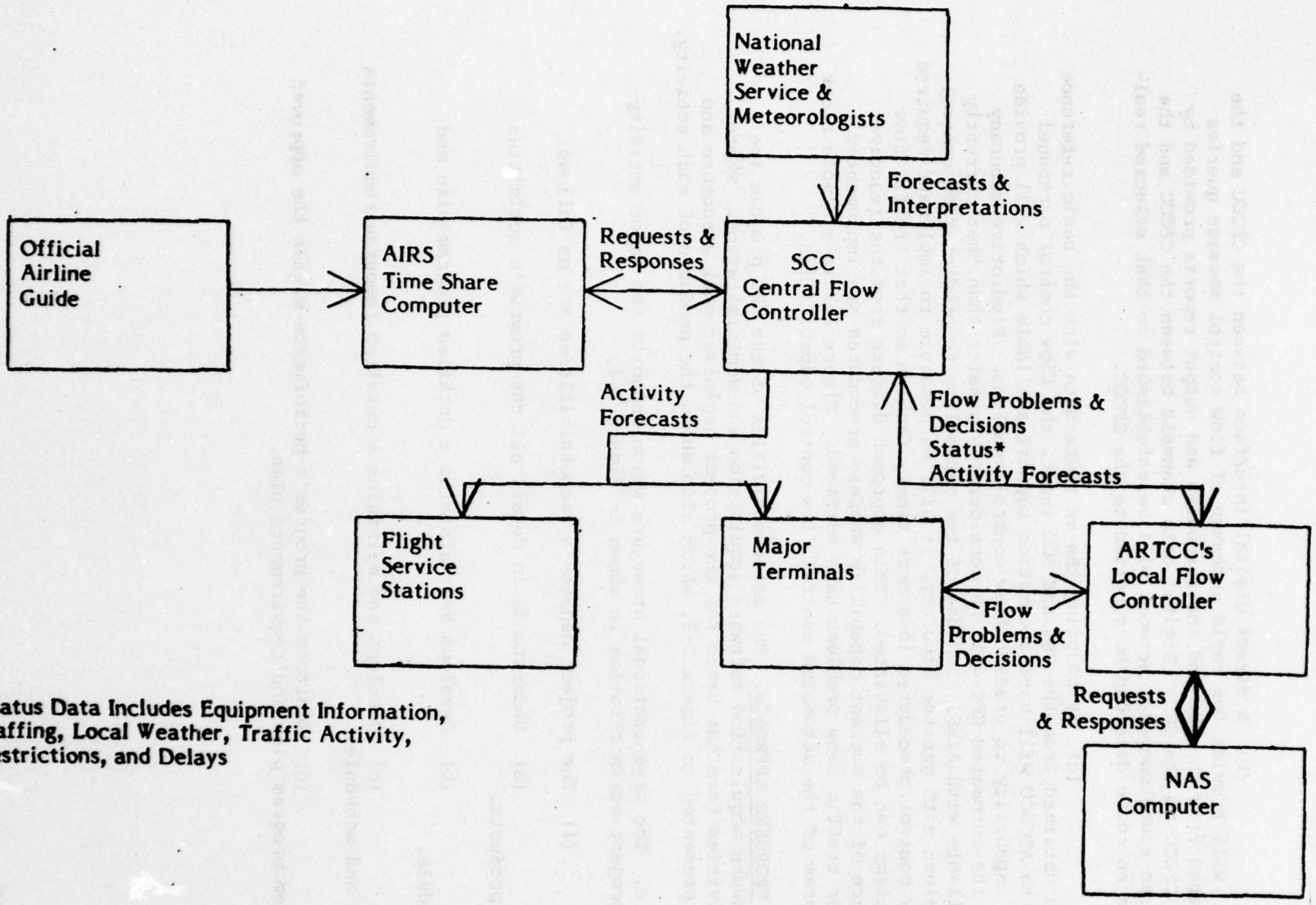
22. PROBLEM DESCRIPTION. The CFCS, as referenced in the Statement of Requirements, AAT-1 letter, December 24, 1975, is an FAA top priority program to develop a centralized automated air traffic management/ predictive system. It will regulate the flow of traffic to an airport considering demand, weather factors, facility status, construction, gate availability, etc.; it will allow for ground holding delays, which will minimize airborne delays resulting in significant fuel savings and smoothing of the traffic flow to coincide with airport capacity.

a. Design Concept. Flow control is the management of the overall pattern of air traffic flow. It is an attempt to balance the volume of air traffic with available traffic handling resources in a way which enables an aircraft to reach its destination with minimum delay. When demand on air traffic control resources exceeds the capacity to handle that demand, the flow control function can be invoked in an attempt to achieve parity in the mass movement of aircraft. Another function of flow control is to provide air carrier offices and other users with information on the overall status of the National Airspace System (NAS) (equipment, facilities, delays, etc.). The central flow controller, located in the SCC, is the decisive authority who initiates systemwide control, and is responsible for evaluating and approving traffic flow redistributions. The flow controller collects situation reports from each ARTCC several times a day, utilizing a direct pushbutton callup and conferencing capability which connects all ARTCCs and major air traffic control towers.

(1) Present Capabilities. In January 1972, the AIRS became operational. AIRS provides demand data for all domestic airports served by air carriers scheduled in the OAG. This capability is for scheduled flights only and does not provide for real-time flight progress input. The program does provide basic data in hourly summary form for each airport's arrivals and departures. AIRS also provides simulated delay prediction reports and flow control reports which are used in the QFLOW and the FAD flow control procedures. All reports are based on the static data base supplied by the OAG input. AIRS does not contain general aviation or military flight data but compensates by incorporating a factor which represents the percentage of this type of traffic with respect to the known scheduled traffic. The current capabilities and interfaces of the central flow controller are shown in figure 2-1. Direct dedicated voice communication lines are provided from the central flow controller to the local flow controller at all ARTCCs and to 19 major terminals. Teletypewriter service to airline dispatchers, flight service stations, and ARTCCs is provided by drops on the Airline Radio Inc. (ARINC), service B, and center B teletypewriter networks, respectively.

(2) System Development Approach. Automation of the central flow control function will give primary responsibility for flow control at both the local and national levels to the controller at the SCC, but much of the local level responsibility will be delegated to the local flow controller. The single sector, short-lived types of problems will be detected, assessed, and resolved by the local flow controller with assistance from other local personnel. Multicenter and national level problems will be handled by the central flow controller with assistance from affected local flow controllers. A problem which impacts the flow of traffic in two or more centers will be coordinated with the SCC before final resolution.

(a) The automation of the CFC function will expand current capabilities by using real-time NAS data concerning the air traffic associated with pacing airports to augment the OAG data and provide a more accurate data base. This data base is generated and maintained on the dedicated CFC IBM 9020A computer to be located at the Jacksonville ARTCC. This facility will be called the CFCCC.



*Status Data Includes Equipment Information, Staffing, Local Weather, Traffic Activity, Restrictions, and Delays

FIGURE 2-1. PRESENT CFC CAPABILITIES

(b) A direct digital interface between the CFCCC and the SCC will provide for rapid exchange of flow control message queries entered from the SCC and the responses and output reports provided by the CFCCC to the SCC. Digital data channels between the CFCCC and the NAS en route computer network will be established so that selected real-time en route data can be supplied to the CFCCC.

(c) By coupling the en route data with the basic reference data obtained from the OAG and SCC input, the flow control personnel at the ATCSCC will have automation support available which will provide the capability to predict flow control problems. Predictive accuracy for the automated CFC will be considerably greater than that currently available with AIRS. Because of the capability to predict flow control problems with greater accuracy, it will be possible to implement required flow control procedures in a more timely fashion so that traffic flow problems can be alleviated. This approach differs from the reactive nature of the current capability wherein procedures are implemented after traffic flow problems have surfaced. Figure 2-2 is a simple block diagram of the automated central flow control capabilities.

23. PROPOSED APPROACH. The major activities of the CFC program are hardware acquisition software acquisition and administration. These activities form the basis for the project organizational structure and are presented in figure 2-3, which also shows the products of each activity.

a. The organizational structure which supports the major activity of project administration is shown in figure 2-4.

(1) The project manager's responsibilities are as follows:

(a) Understands in detail all the program's activities and products.

(b) Develops and maintains a detailed program plan and schedule.

(c) Develops and maintains a detailed resource requirements plan and schedule.

(d) Monitors the program's performance within the approved system program plan and requirements plan.

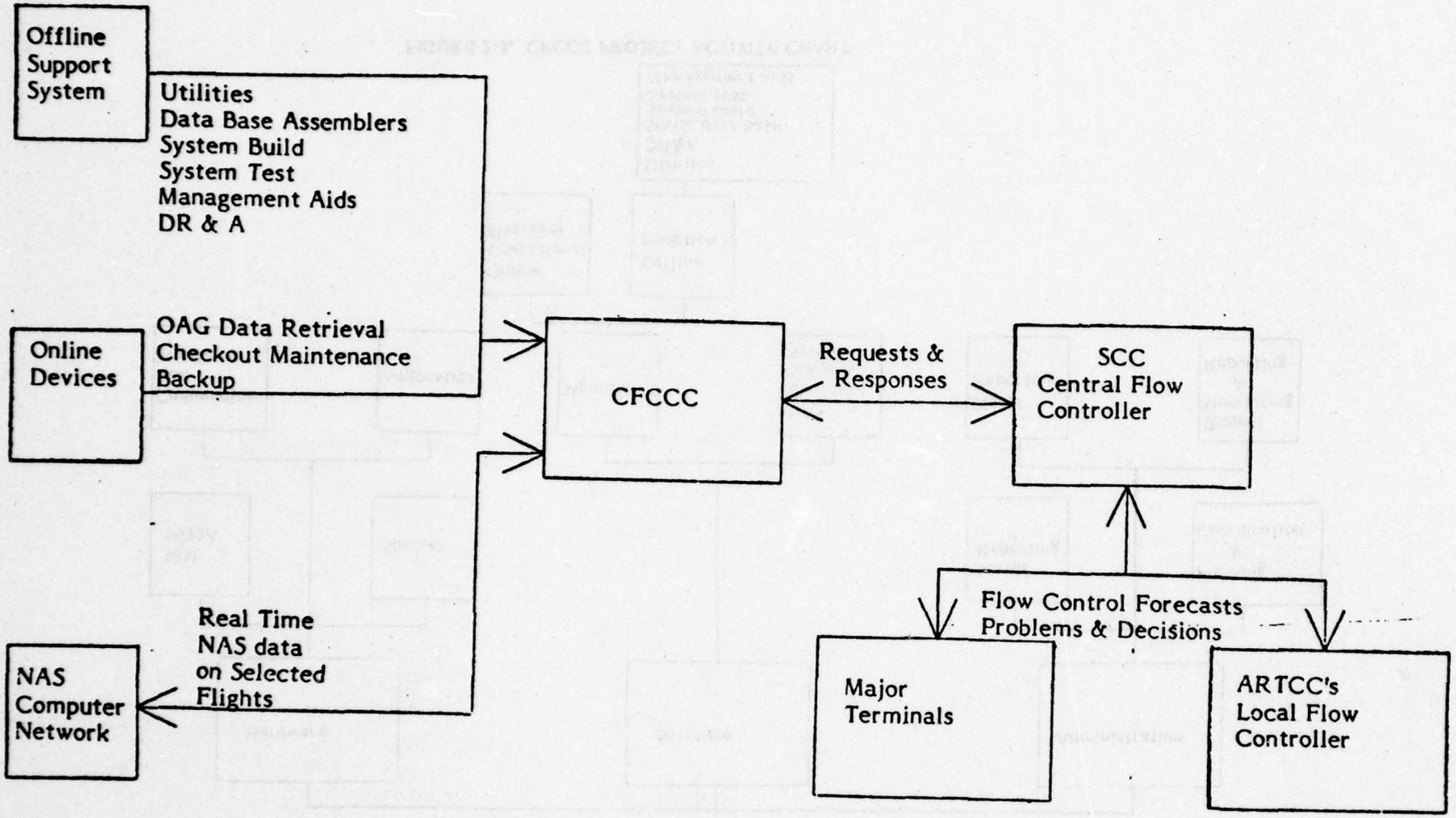


FIGURE 2-2. AUTOMATED CFC CAPABILITIES

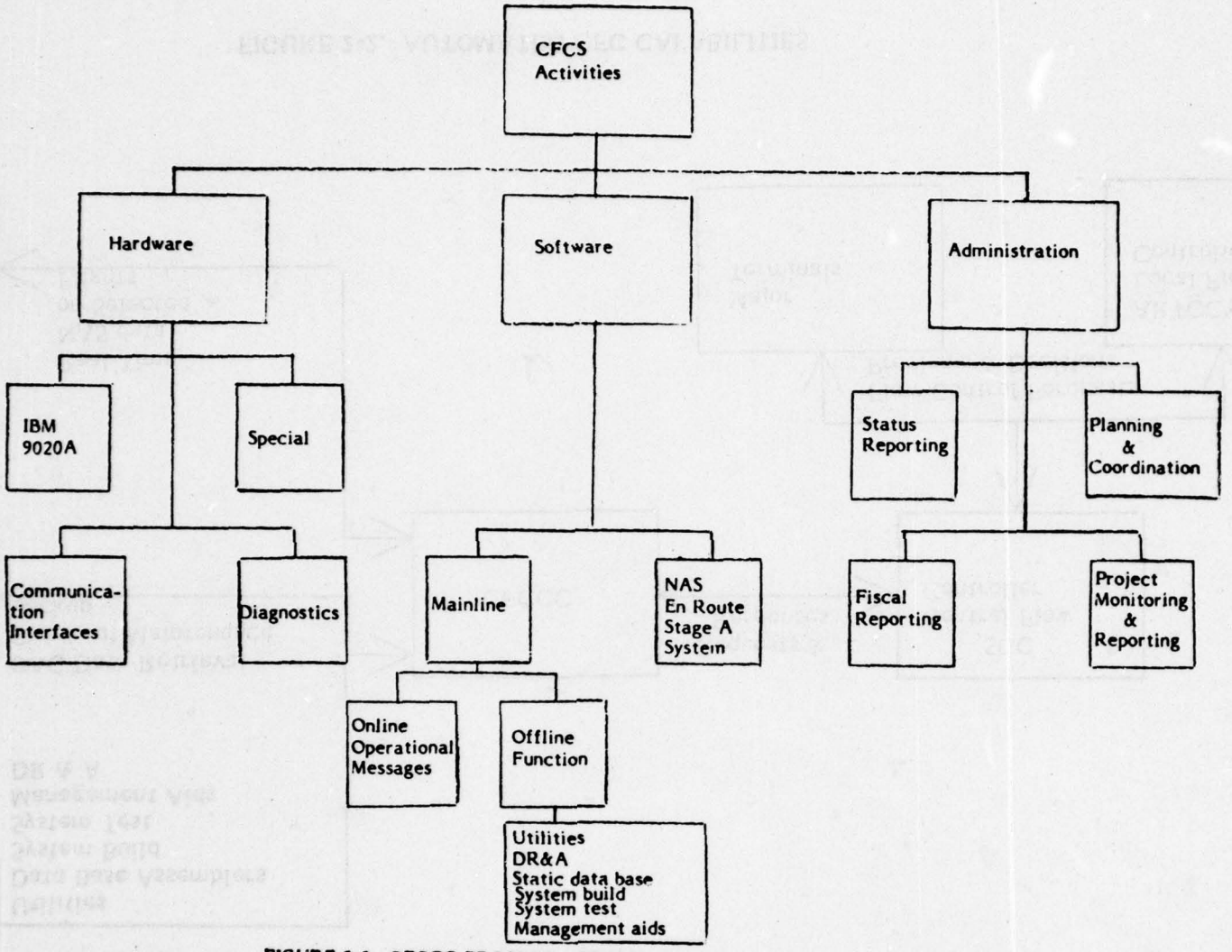


FIGURE 2-3. CFCCC PROJECT ACTIVITY CHART

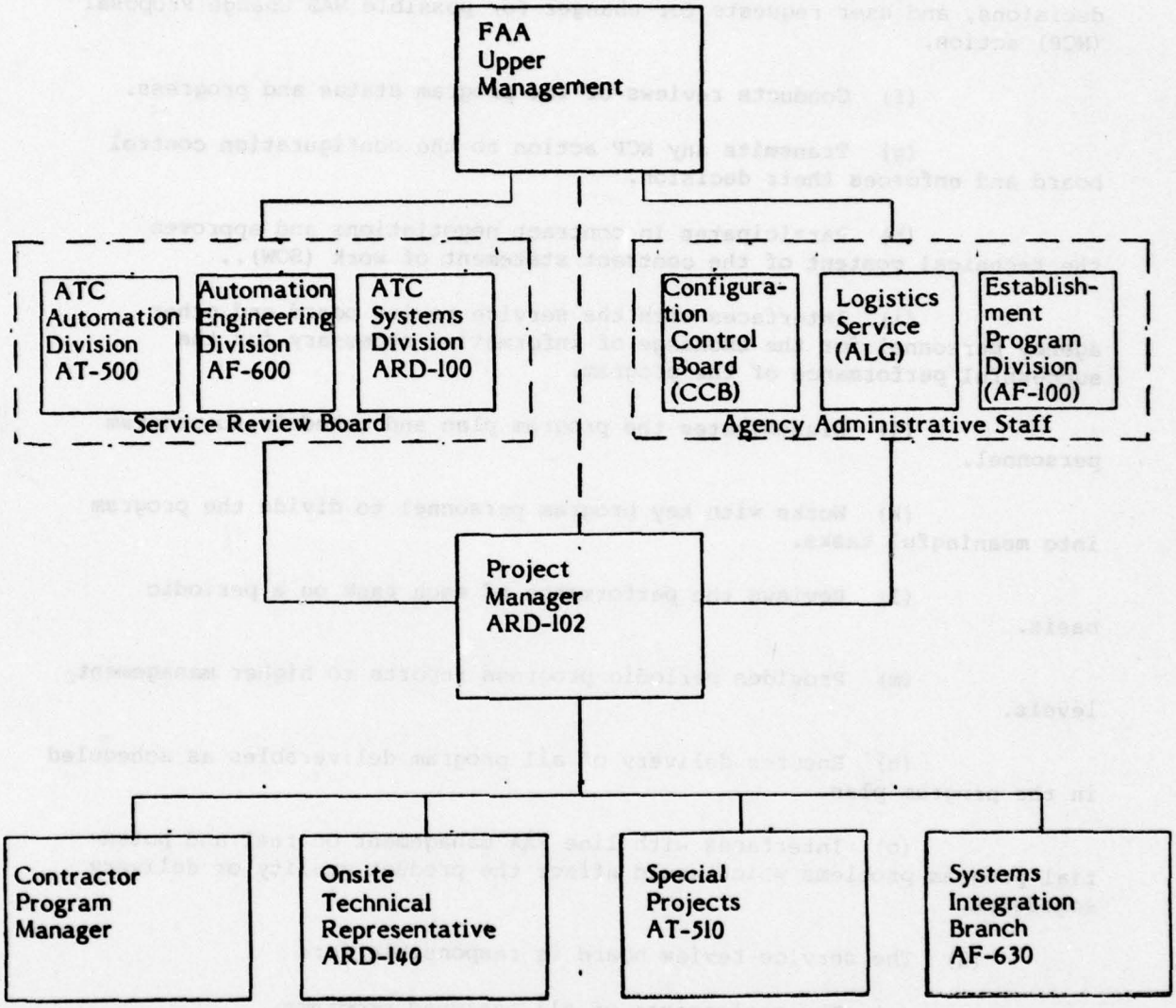


FIGURE 2-4. PROJECT ADMINISTRATION ACTIVITY

(e) Reviews all the technical, performance, and management decisions, and user requests for changes for possible NAS Change Proposal (NCP) action.

(f) Conducts reviews of the program status and progress.

(g) Transmits any NCP action to the configuration control board and enforces their decision.

(h) Participates in contract negotiations and approves the technical content of the contract statement of work (SOW)..

(i) Interfaces with the service review board and other agency personnel for the exchange of information necessary for the successful performance of the program.

(j) Disseminates the program plan and schedule to program personnel.

(k) Works with key program personnel to divide the program into meaningful tasks.

(l) Reviews the performance of each task on a periodic basis.

(m) Provides periodic progress reports to higher management levels.

(n) Ensures delivery of all program deliverables as scheduled in the program plan.

(o) Interfaces with line FAA management on real and potential program problems which would affect the product quality or delivery schedules.

(2) The service review board is responsible for:

(a) The performance of all assigned programs.

(b) Approving a plan and schedule for each project and task and for reviewing the basic information required to support the budget process.

(c) The assignment and use of resources on the programs.

(d) The quality and timeliness of the product.

(e) Conducting periodic performance review meetings with emphasis on major milestones, resource allocations, and problem areas.

(f) Monitoring the program's financial condition.

(g) Ensuring that the FAA receives a satisfactory product.

(h) Presenting periodic program reviews to higher management.

(3) Agency administrative staff responsibilities are shown below.

(a) The Logistics Service (ALG) is responsible for:

1 Supplying the official FAA representative (Contracting Officer) in all contractual matters.

2 Acting as the sole contact with the contractor's contracting office.

3 Negotiating all contract changes and modifications in coordination the program manager and his upper level line management.

4 Officially accepting all contract deliverables, upon advice and consent of the program manager.

5 Auditing the program cost reports and notifying all concerned parties of any funding problems.

6 Providing for official contract administration.

7 Providing industrial engineering support and production surveillance.

8 Providing policy and procedural guidance to the program manager on all contractor related matters.

(b) The Configuration Management Staff (CMS), AAF-40, is responsible for:

1 Establishing and maintaining an approved baseline configuration for the CFC subsystem of the NAS.

2 Providing for the management of changes to the baseline end items taking into account need, cost effectiveness, and schedule impact.

3 Receiving, reviewing, and processing all NCPs against the CFC baseline in accordance with FAA Order 1800.8D.

(c) The Establishment Program Division, AAF-100, is responsible for:

1 Applying or reapplying, in conjunction with the Office of Budget, funds identified as direct costs in accordance with established budgetary procedures.

2 Maintaining an accounting of all accumulative costs incurred by the program.

b. The organizational structure which supports the major activity of hardware acquisition is represented in figure 2-5.

(1) The Systems Integration Branch, AAF-630 is responsible for:

(a) Preparation, planning, conducting, coordination, monitoring, reporting, and documenting of all activities associated with hardware acquisition and installation.

(b) Assuring facilities and equipment (F&E) funding for CFC automation establishment activities and installation are provided.

(c) Providing system establishment requirements, layouts, power requirements, etc. to the regions and support the development of site implementation plans.

(d) Providing factory acceptance testing of purchased equipment.

(e) Providing for hardware integration and shakedown testing and prepare test plans as required.

(f) Providing for a maintenance and operations staff.

(g) Providing a maintenance plan.

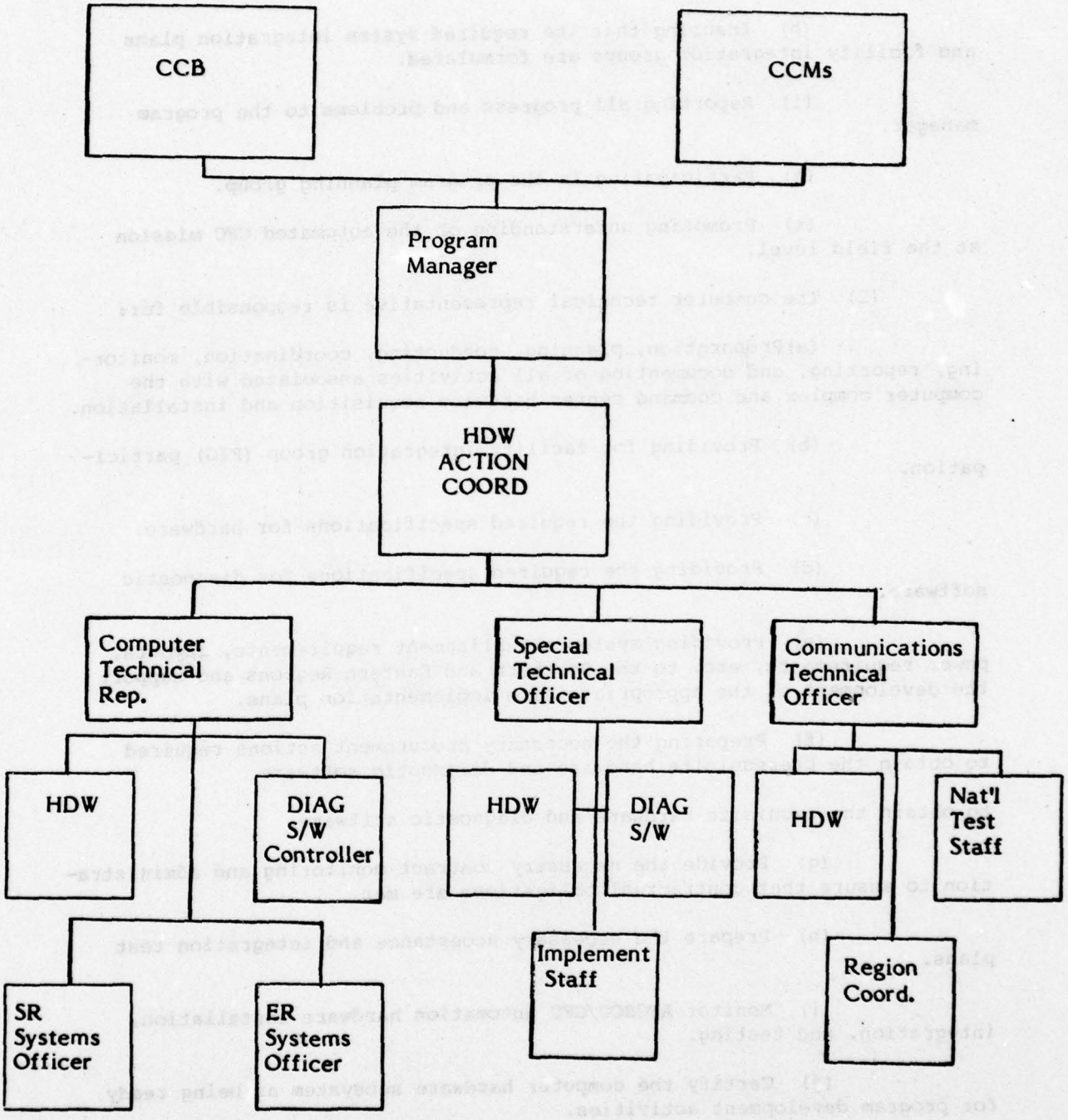


FIGURE 2-5. HARDWARE ACTIVITY ORGANIZATIONAL CHART

(h) Insuring that the required system integration plans and facility integration groups are formulated.

(i) Reporting all progress and problems to the program manager.

(j) Participating in the program planning group.

(k) Promoting understanding of the automated CFC mission at the field level.

(2) The computer technical representative is responsible for:

(a) Preparation, planning, conducting, coordination, monitoring, reporting, and documenting of all activities associated with the computer complex and command center hardware acquisition and installation.

(b) Providing for facility integration group (FIG) participation.

(c) Providing the required specifications for hardware.

(d) Providing the required specifications for diagnostic software.

(e) Providing system establishment requirements, layouts, power requirements, etc. to the Southern and Eastern Regions and support the development of the appropriate site implementation plans.

(f) Preparing the necessary procurement actions required to obtain the prerequisite hardware and diagnostic software.

to obtain the requisite hardware and diagnostic software.

(g) Provide the necessary contract monitoring and administration to assure that contractual obligations are met.

(h) Prepare the necessary acceptance and integration test plans.

(i) Monitor ATCSCC/CFC automation hardware installation, integration, and testing.

(j) Certify the computer hardware subsystem as being ready for program development activities.

(3) Responsibilities of the diagnostic software contractor are as follows:

(a) Respond to solicitation.

(b) Sign an appropriate contract.

(c) Analyze the computer program functional specifications for the diagnostic software and produce an appropriate program design.

(d) Participate in a critical design review of the diagnostic software.

(e) Integrate the software into the required maintenance software system.

(f) Participate with the onsite engineering representative in acceptance testing of the software.

(g) Participate as required in the hardware integration and shakedown activities.

(4) Responsibilities of the hardware contractor are as follows:

(a) Respond to solicitation.

(b) Sign an appropriate contract.

(c) Build hardware to specifications.

(d) Participate in factory inspection and acceptance testing.

(e) Ship equipment to the specified site.

(f) Uncrate and place equipment at the site in accordance with the site implementation plan.

(g) Perform initial integration and inspection activities and tests.

(h) Participate in hardware shakedown and acceptance tests.

(i) Coordinate all activities with the onsite engineering representative.

(j) Perform all reporting and documentation activities as required.

(5) Responsibilities of the Southern Regional systems officer are as follows:

(a) Provide a regional onsite coordinator and an onsite engineering representative for participation in the CFC automation program activities.

(b) Provide personnel for participation on the FIG.

(c) Provide the regional coordination, direction, and guidance necessary for effective and timely accomplishment of site preparation, installation, testing, evaluation, and precommissioning functions during the CFC automation implementation.

(d) Provide for the onsite installation integration and checkout of the CFC computer complex.

(e) Provide a staff of computer operators.

(f) Provide the required maintenance staff.

(g) Provide the logistical support required for the computer complex (i.e., paper, cards, tapes, disks, spare parts, etc.).

(h) Participate as required during testing activities.

(6) Responsibilities for the Eastern Regional systems officer are as follows:

(a) Provide a regional onsite coordinator and an onsite engineering representative for participation in the CFC automation program activities.

(b) Provide personnel for participation on the FIG.

(c) Provide the regional coordination, direction, and guidance necessary for effective and timely accomplishment of site preparation, installation, testing, evaluation, and precommissioning functions during the system command center automation implementation.

(d) Complete the site preparation tasks as required.

(e) Provide for the onsite installation, integration, and checkout of the CFC systems command center.

(f) Provide the required maintenance staff.

(g) Participate as required during testing activities.

c. The CFCS software activity is composed of two major subdivisions:

(1) The first is the operational and support software which is to be contractor developed. The second subdivision is the interface with the NAS en route stage A system. The contract management plan for developing the operational and support software is detailed below and charted on figure 2-6.

(a) Washington Headquarters.

1 FAA program management staff.

a Provide the technical officer (TO) on the Central Flow Control with the responsibilities as outlined in the Contracting Officers letter of designation.

b The configuration management staff maintains case files and coordinates approval activities.

c The program manager is responsible for program planning and reporting.

2 The responsibilities of the appropriate configuration manager is to review change requests after proper documentation and coordination and to approve or disapprove the change.

3 The FAA configuration management staff, AAF-40, is responsible to the configuration manager for coordinating and accumulating cost, schedule, technical and operational impact of proposed changes and for summarizing and recommending a decision for or against approval.

4 The FAA Contracting Office (ALG-300) will provide financial guidance.

(b) National Aviation Facilities Experimental Center (NAFEC). The technical review board at NAFEC is responsible for:

1 Technical certification of the following contract deliverables:

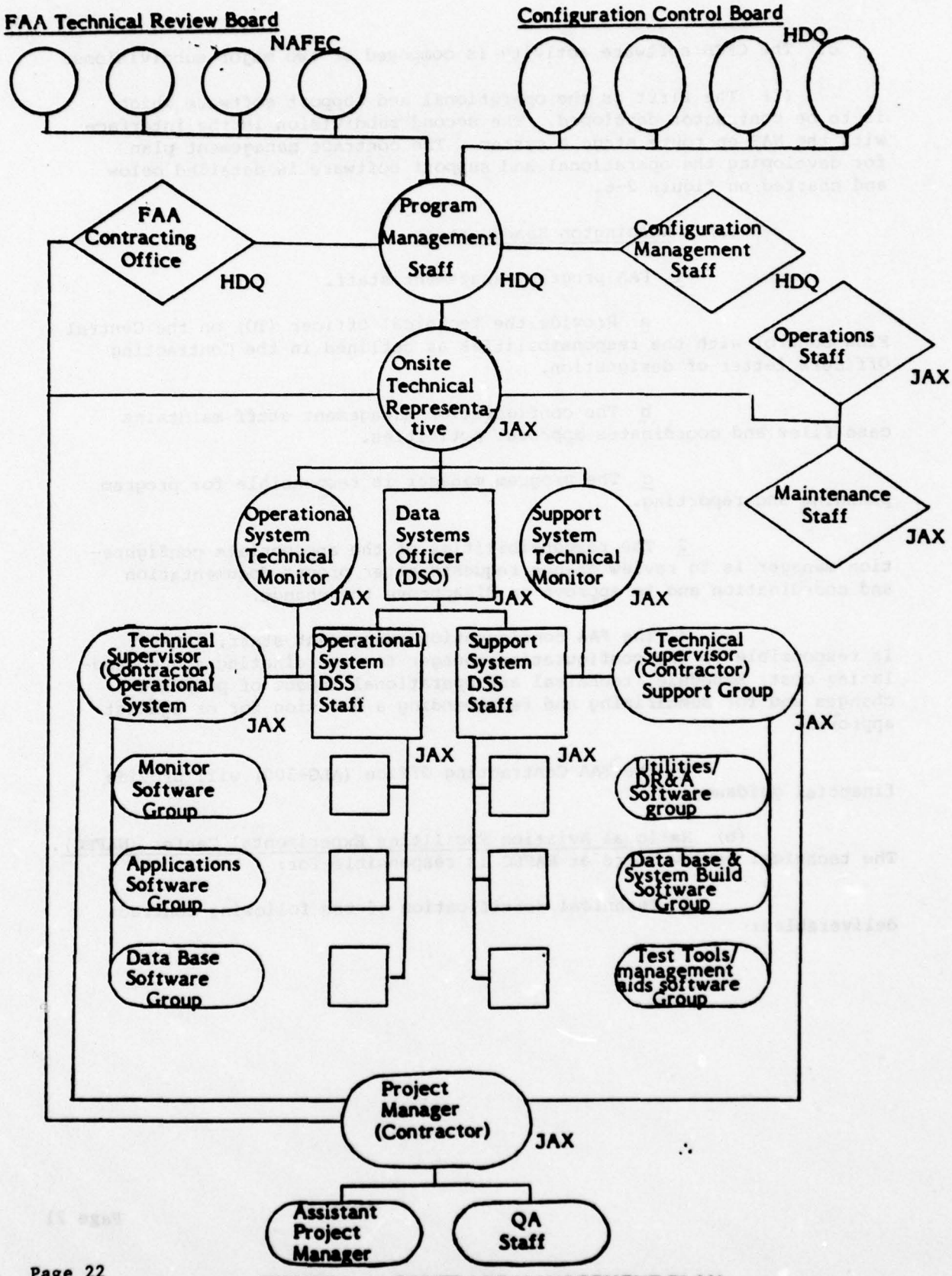


FIGURE 2-6. CONTRACT MANAGEMENT PLAN

a Software products. This includes certification of central flow control system at the levels indicated: the operational and support subsystems, components, and modules (as identified in system design data (SDD) and program design specification (PDS)). Responsibilities also include certification of the data base at the levels indicated: files (includes COMPOOL), records, data aggregate (vector, repeating group), and data items.

b Documentation products. Certification of these products are in two phases. The first phase, based on CPFS FAA-RD-76-157, includes the PDS, acceptance test specifications and procedures, acceptance test reports, SDD, executive/monitor handbook, operator's manual, user's manual, and progress reports. The second phase is based on individual task orders, as defined.

2 Technical evaluation and review support.

a Standards. Evaluation and review includes coding based on request for proposal (RFP) ATT A, Programing Requirements, and documentation based on FAA-SRDS-140-SDS-1 as amended for CFC by "Computer Program Development and Documentation," appendices A, C, D, and F.

b Test specification. Develop specifications to the "component" level and review at the "module" level and below.

c Test procedure. Develop procedures to "component" level and review at "module" level and below.

3 Technical consultation.

a Analysis. This includes GFE support and assistance, and approval and comments on technical approach.

b Performance evaluation. Including system progress, utilization, throughput, response, time, experimentation, and recommendations.

c Research. Continued program involvement test bed establishment, data reduction and analyses, technology assessment, modeling (C.F. FEDSIM MV-046-055-DOT).

(c) CFCCC - Jacksonville (JAX).

1 FAA onsite technical representative.

a Delegated COTR responsibility/authority. Responsibilities include control of the contract within the scope of the SOW, coordination of contract activities (including contractor organization, tenant data system staff (DSS) organization, resident support service organizations, national data network organizations, and headquarters program management staff), and receipt of and accounting for contract deliverables and status reports.

b Administrative responsibility/authority. Responsible for supporting subordinate technical monitors.

2 FAA operational system technical monitor.

a Coordination of development activities. Included in these activities are software products, more specifically in-scope specification interpretation, initial product review, DSS code audit assignment and review, DSS code analysis assignment and review, test initiation and termination; documentation products, more specifically, in-scope specification interpretation, initial product review, DSS coordination assignment and review; and status report and verification, including initial review and technical evaluation.

b Coordination of training activities. Training activities are contractor training, DSS training, computer operations staff training, and SCC operations staff training.

3 FAA support system technical monitor.

a Coordination of development activities. Same as in (c)2a above.

b Coordination of training activities. Same as in 23c.(1)(c)2b above.

4 FAA data systems officer.

a DSS administration.

b Program management - DSS liaison.

c Data systems officer (DSO) responsibilities/authority as prescribed.

5 FAA operational system DSS.

a Deliverable product certification provides certification support for software products, including code auditing procedure and review, code analysis procedure and review, test participation, test result documentation, preliminary test result analysis, and documentation products, including operational acceptability reviews.

b Program installation support. Software and documentation products will be supported by production library maintenance, including all certified products and accounting records and reports.

c Program development support. Support in this area will be in reference library maintenance and operational procedure expertise.

d Program performance evaluation will be provided through research and analysis.

6 FAA support system DSS.

a Deliverable product certification support, as in 23.c.(1)(c)5a above.

b Program installation support, as in (c)5b above.

c Program development support, as in (c)5c above.

d Program performance evaluation, as in (c)5d above.

7 Contractor project management staff.

a Contractor staff administration. Responsibilities will include task assignment and accounting, task evaluation and review, and personnel actions.

b Development activity management. The scope of responsibility includes in-scope policy and procedure, more specifically, standards and reporting; and deliverable product quality assurance for software, documentation, and reports.

8 Contractor operational system staff and support system staff.

a Deliverable product certification support. Support of software products includes code and analysis auditing, test participation, test result documentation, and preliminary test result analysis. Support of documentation products includes a preliminary edit and operational acceptability.

b Program installation support. Support of software products includes production library maintenance, more specifically, copy-over, backup and recovery, index/cross-index, reference disk, and maintenance. Support for documentation products includes production library maintenance, more specifically, cataloguing, indexing, and updating.

c Program development support. Reference library maintenance, including vendor package documentation, operational documents, specifications, standards, procedures, and all production library functions. Program performance evaluation of man/machine interface will be by recommendations only.

9 The support services of the FAA computer operations staff include computer operator and peripheral equipment operator staffing; consumable provisioning; resource accounting; and performance evaluation reporting.

10 The support services of the FAA computer maintenance staff include computer and peripheral equipment preventive maintenance and repair; spare parts provisioning; resource accounting; and performance evaluation and reporting.

(2) NAS en route interface management plan. Figure 2-7 represents the management plan for the NAS en route interface with CFCCC. The ATC Automation Division, AAT-500, will be responsible to the project manager for transmitting flight data information for flow control purposes to the CFCCC. Five selected en route facilities, designated as "store-and-forward" facilities shall assemble flow control messages generated internally along with flow control messages received from adjacent en route facilities for relay to the CFCCC. "Nonstore-and-forward" en route facilities shall transmit internally generated flow control messages to a designated "store-and-forward" facility. After CFCS is operational, the ATC Operations and Procedures Division, AAT-300, will be responsible for the CFC message relay from the en route facilities to the CFCCC.

d. Scheduling, Monitoring, and Controlling Program Implementation. Systems Research and Development Service (ARD) is the office of prime responsibility (OPR) for CFCS program implementation. Personnel engaged in these efforts need to have a common understanding of the timing and the relationships among the various activities and events of the program. In order to fulfill this need and maintain effective control of the program, there must be a single control source for schedule information on key program events. That responsibility lies with the program manager. Figure 2-8 presents a summary program evaluation review technique (PERT) chart.

e. Schedule Changes. Events contained in the ARD schedules can only be added, deleted, or changed by written permission of the Director, Systems Research and Development Service. Schedule change requirements should be submitted to ARD-100. When offices or services have a recommended schedule change, they should advise ARD by letter to the Director (ARD-1), attention: ARD100. Follow-on action and coordination are to be completed by ARD-100 and, if approved, the change will be reflected in the next update of the official schedules.

24. SUPPORTING FAA ORGANIZATIONS.

a. Participating Organizations. The Systems Research and Development Service, Air Traffic Service, Airway Facilities Service, and the Eastern and Southern Regions have primary responsibilities in automating the CFC system. Figure 2-9 represents an organizational structure of the FAA offices and services which support the CFCS project activities. Essential to the successful accomplishment of this program is the coordination with all offices, services, centers, regions, and other organizations that have responsibilities in the implementation of the system. Enumerated below are responsibilities which must be met by the organizations to ensure the timely completion of the CFC activities.

(1) Washington Staff.

(a) Systems Research and Development Service.

1 Act as chairman for working groups and boards established in support of CFC when required.

2 Provide program guidance to all offices, services, centers, and regions on the implementation of the CFC program.

3 Prepare, analyze, and distribute scheduling information to all interested organizations.

4 Ensure the timely implementation of CFC into the operational environment.

5 Be responsible for providing site preparation standards to the regions for monitoring the accomplishment of site activities leading toward the completion and acceptance of the site activities.

6 Be responsible for system testing culminating in an operational readiness demonstration (ORD) prior to turnover to user.

7 Provide technical surveillance of contractors in the design, development, production, testing, installation, and integration of hardware and software for CFC.

8 Provide the technical officer (TO) on the CFC contract with responsibilities as outlined in the CO's letter of designation.

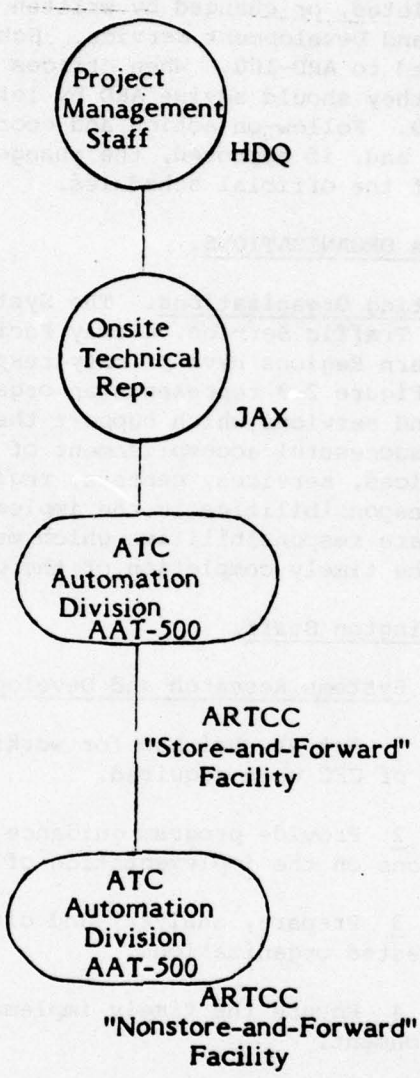
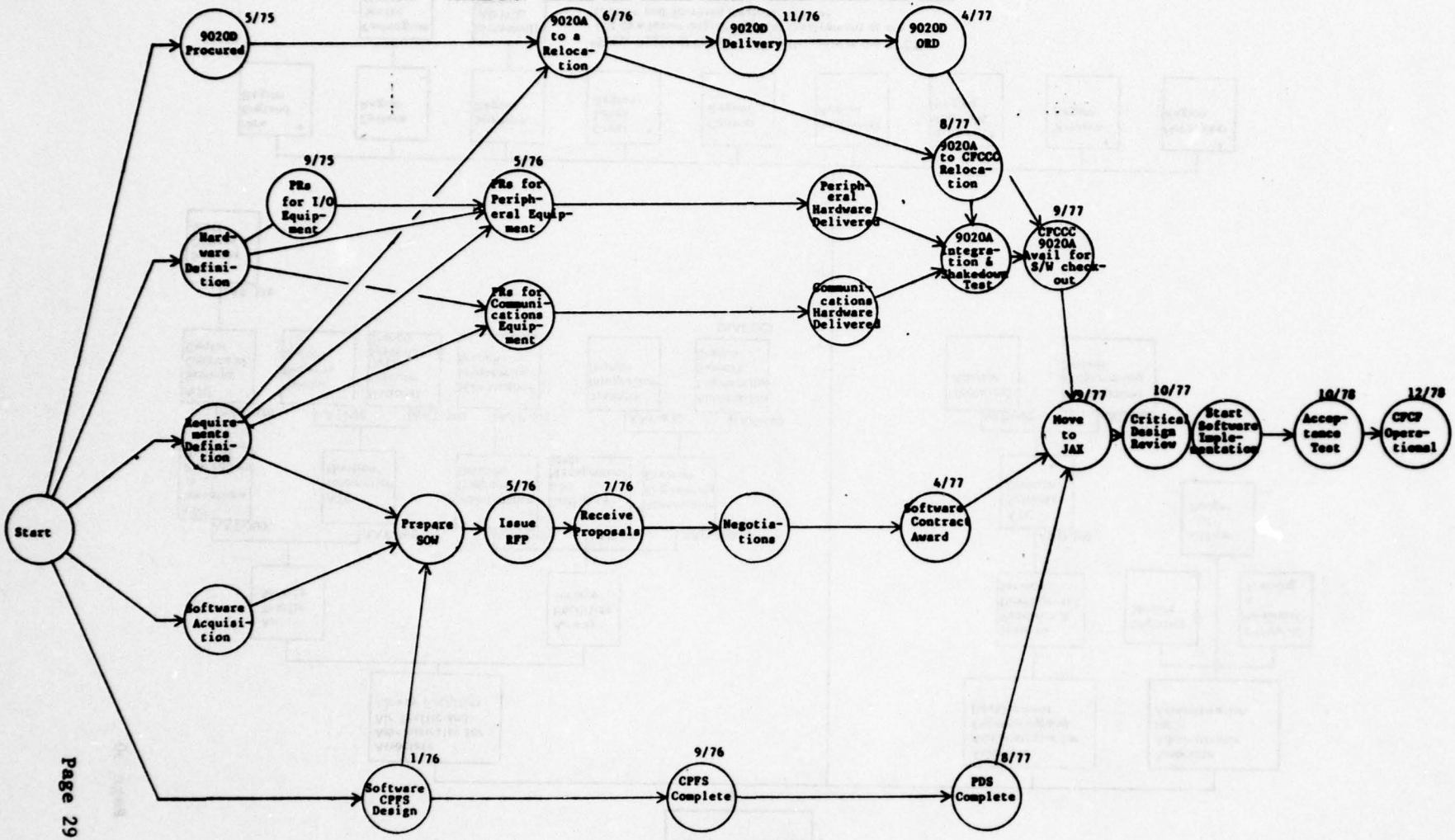


FIGURE 2-7. NAS ENROUTE INTERFACE MANAGEMENT PLAN

FIGURE 2-8. CENTRAL FLOW CONTROL FACILITY SYSTEM SUMMARY PERT CHART



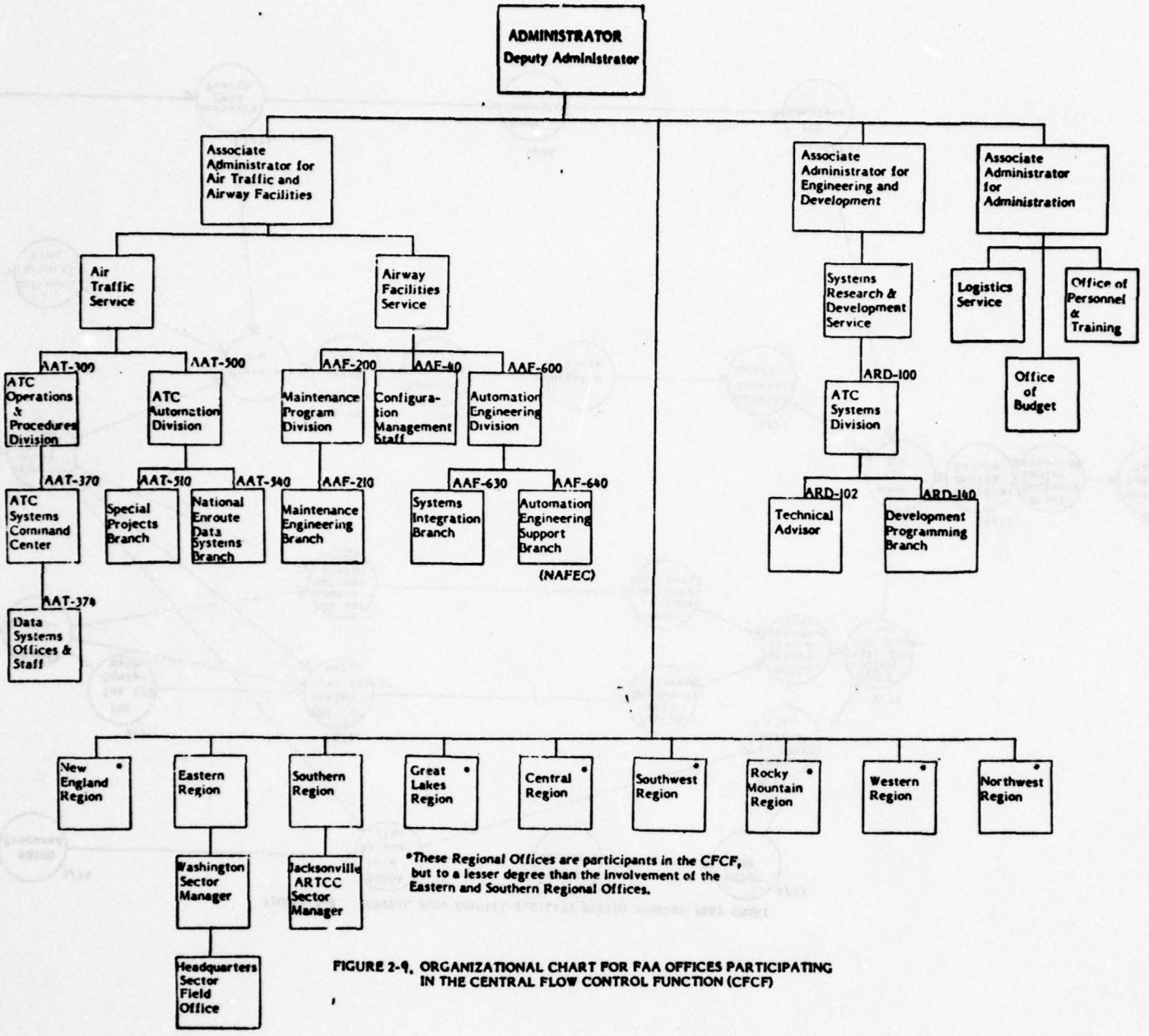


FIGURE 2-9. ORGANIZATIONAL CHART FOR FAA OFFICES PARTICIPATING IN THE CENTRAL FLOW CONTROL FUNCTION (CFCF)

9 Ensure and assist in the development of system shakedown and operation changeover plans with AAT, AAF, and the regions.

10 Define operational standards in coordination with AAT and AAF, including operational requirements in support of the CFC program.

11 Provide direction to the contractor in the development and testing of the ATC operational programs and interpretation of ATC operational and functional specifications.

(b) Air Traffic Service.

1 Provide operational requirements to yhe System Research and Development Service (SRDS).

2 Provide technical coordination and support to the SRDS TO on matters relating to the ATC functions and operational requirements for interface with the NAS en route stage A system.

3 Provide membership to the program planning group and facility integration group.

4 Participate in the development of system shakedown and operations changeover plans.

5 Design, develop, test, and implement the necessary changes to the NAS en route stage A system software to provide interface with CFC.

6 Provide maintenance of operational software after development is complete.

(c) Airway Facilities Service.

1 Prepare, plan, conduct, coordinate, monitor, report, and document all activities associated with hardware acquisition and installation.

2 Provide F&E funding for CFC automation establishment activities and installation.

3 Provide system establishment requirements, etc. to the regions and support the development of site implementation plans.

4 Provide factory acceptance testing of purchased equipment.

5 Provide for hardware integration and shakedown testing and prepare test plans as required.

6 Provide for a maintenance and a computer operators staff.

7 Provide a maintenance plan.

8 Insure that the required system integration plans and facility integration groups are formulated.

9 Report all progress and problems to the program manager.

10 Participate in the program planning group and facility integration group.

11 Promote an understanding of the automated CFC mission at the field level.

12 Provide the required specifications for diagnostic software for new equipment.

13 Prepare the necessary procurement requests and conduct the necessary procurement actions required to obtain the requisite hardware.

14 Provide the necessary contract monitoring and administration to assure that contractual obligations are met.

15 Prepare the necessary acceptance and integration test plans.

16 Monitor ATCSCC/CFC automation hardware installation, integration, and testing.

17 Certify the computer hardware subsystem as being ready for program development activities.

18 Implement the diagnostic software and integrate it into the required maintenance software system.

19 Participate with the onsite engineering representative (OER) in acceptance testing of the software.

(d) Logistics Service.

1 Provide all necessary procurement actions, including contract administration, and enter into contract(s) between FAA and contractor(s) for CFC related items.

2 Provide industrial engineering support and production surveillance of program management and contract administration.

3 Provide policy and procedural guidance to the ATCSCC and the Southern Region for appropriate CFC property controls and records maintenance.

4 Determine adequacy of contractor's quality and reliability programs and inspection systems, furnish administrative CO for contract administration, and accept or reject systems and equipment persuant to the terms and conditions set forth in the contract.

(e) Office of Personnel and Training.

1 Establish guidelines and standards for the selection of employees and the classification of positions.

2 Advise and assist in the timely recruitment of personnel to meet staffing selection and training requirements.

3 Analyze training requirements, approve training program development, assign training responsibility, and approve and review all associated CFC training schedules.

4 Establish a training program for the CFC automation program.

5 Provide a contracting officer's representative (COR) to the CO on technical contract training, training matters, and training requirements.

(f) Office of Budget. Provide for the administrative actions necessary to acquire funds for the implementation and operation of the system.

(2) Field Organizations.

(a) Regions.

1 Regional onsite coordinators (ROE) will be designated at the System Command Center (Eastern Region) and at the CFCC at Jacksonville Center (Southern Region). The ROEs will work closely with the ARD-100 office. As required by the region, the ROE will participate in the CFC automation program activities.

2 An onsite engineering representative (OER) will be designated by both the Eastern and Southern Regions and will provide the regional coordination, direction, and guidance necessary for effective and timely accomplishment of site preparation, installation, testing, evaluation, and precommissioning functions during the CFC automation implementation at the respective site. This includes onsite decisionmaking and day-to-day problem solving. The chief, ARD-100, will make periodic visits to the site to maintain thorough knowledge of the program status and also to assist the OER in implementing the automation program. The OERs will be the principal interface between the Eastern and Southern Regions and ARD-100. Administrative channels of communication between the Western, Central, and Great Lakes Regions, and ARD-100 will be utilized when the automation interfaces with the CFCCC and the NAS en route ATC system.

3 The Eastern and Southern Regions will provide personnel for participation in the FIG.

4 The Eastern and Southern Regions will provide the regional coordination, direction, and guidance necessary for effective and timely accomplishment of site preparation, installation, testing, evaluation, and precommissioning functions during the CFC automation implementation.

5 The Eastern and Southern Regions will provide participation as required during testing activities.

6 The Eastern and Southern Regions will provide the required maintenance staff.

7 The Eastern Region will provide support for the onsite installation, integration, and checkout of the systems command center.

8 The Southern Region will provide for onsite installation, integration, and checkout of the CFC computer complex.

9 The Southern Region will provide a computer operators staff.

10 The Southern Region will provide logistical support required for the computer complex (i.e., paper, cards, tapes, disks, spare parts, etc.).

11 The regions participating in the CFCS will conduct system shakedown and operations changeover testing in accordance with the requirements of the test plans for these functions.

12 The regions participating in the CFCS automation will provide proper administrative channels of communication to assure the project manager (ARD-100) full cognizance of project status at all times.

b. Management Groups. Ad hoc CFC program groups are to be formed as required to develop conclusions and recommendations for changes in planning, program implementation, and evaluation. The findings of these groups will be decided upon by the program management staff.

(1) CFC Program Planning Group. The following services have a major interest in most facets of the subjects to be dealt with and shall designate member(s) to the program planning group:

(a) Systems Research and Development Service (chairman).

(b) Air Traffic Service.

(c) Airway Facilities Service.

(2) Duties of Members. Responsibilities of designated members include the following:

(a) Act as focal point within their respective organizations for CFC program planning.

(b) Provide liaison between the planning group and their respective organizations to obtain review and comment on implementation matters.

(c) Keep their respective organizations informed of program activities.

(3) Facility Integration Group. The FIG is to be comprised of designated onsite AAT and AAF personnel who are to be experienced in implementation of electronic and/or automation systems and responsive to the guidance and direction of the OER. The OER is to be guided by approved test documentation which designates what must be done and by whom. Personnel assigned to the FIG are to be engaged in test and monitor activities prior to initial operating capability (IOC) and are to be actively engaged in test activities subsequent to IOC.

25. FUNDING AND RESOURCES.

a. System Funding. Planned F&E funding levels for the CFCF automation program are shown below:

($ in thousands)

	FY 76	FY 77	FY 78	TOTAL
Funding Level	7,600	4,073	0	11,673

b. Financial Planning. Guidelines for the formulation and submission of agency budget requirements are contained in Order 2500.10J, Call for Estimates - General Information and Policies (RIS: BU2500-4), and other agency directives. Procedures in these directives and in other special instructions issued relating to funding for the CFC automation program provide for funding under two of the appropriations granted the agency.

(1) Facilities and Equipment. This appropriation covers all F&E costs associated with the procurement, installation, and checkout of the hardware and software of the CFCS.

(2) Operations. This appropriation covers:

(a) Additional AAT and AAF positions necessary for the operation and maintenance of the CFCS facilities and associated support.

(b) Follow-on supply support capability.

c. Regional/Aeronautical Center F&E Cost Estimates. The majority of regional F&E costs are to be associated with site preparation work. Other costs are related to engineering and site installation/management activities. Regions are to follow normal procedures in developing detailed cost estimates for the sites requiring CFCS equipment. These cost estimates are to be prepared based on the information contained in this system plan and any other special instructions issued. They are to be submitted in accordance with Agency Order 2510.5, Fiscal Programing and Reporting Procedures for the F&E Appropriation.

d. Program Costs. Funding for the CFC automation program has been provided by Congress in the FY 1976 (hardware) and FY 1977 (software) budgets. Regional cost estimates are required to make proper adjustments to headquarters' estimates of regional costs.

e. Related F&E Projects. Data terminal equipment (DTE) acquisition.

26. REPORTING AND CONTROL OF PROGRAM BRIEFINGS. The transfer of information about program objectives, systems overviews, operational procedures, and status of program implementation will be accomplished via briefings to be given at the Eastern and Southern Regional Offices and at the ATCSCC in Washington. These briefings will be supplemented by training courses with assistance from the Office of Personnel and Training.

27.-30. RESERVED.

CHAPTER 3. DEVELOPMENT AND IMPLEMENTATION PHASE

31. INTRODUCTION. This phase involves the specification of the development products, the procurement of the required resources, and the implementations and commissioning of the system. Adequate planning and control must be provided in this phase, especially in the areas of scheduling, internal budgeting, and technical review. This section will describe the development activities, the implementation activities, and testing activities required to produce an acceptable product. Finally, the configuration management plan and the reporting and control mechanisms and vehicles specific to the conduct of the program will be discussed. Appendix 1 gives a description of the CFCS software and hardware.

32. DEVELOPMENT ACTIVITY.

a. System Requirements. The automated CFCS will aid the central flow controller in providing safe, orderly, and economic movement of air traffic in the national airspace by providing the capability to predict traffic congestion and manage traffic flow to minimize en route delays. The overall objective of the automated CFCS is to increase ATC system safety, improve energy conservation, and provide more timely and accurate service to the user.

b. System Characteristics. The AIRS, which is currently in use by the central flow controller at the SCC, is the prototype of the new automated CFCS. The AIRS data base provides information on scheduled air traffic based on the OAG tape input and other data entered by SCC personnel. The new system will incorporate a real-time interface between the CFC computer and the NAS en route ATC system in order to more accurately identify actual traffic loads and provide prediction capabilities to prevent congestion problems. This interface will be in the form of selected messages generated by the NAS which can supplement or update the CFC data base. The CFC program will establish a dedicated computer facility at the Jacksonville Center CFCCC. The SCC will have five operational positions that interface with the CFCCC. Offline portions of the system will provide capabilities for system development, system performance monitoring, and system maintenance.

c. System Interfaces. The CFCCC will interface on-line with the NAS en route stage A air traffic control system for flights that are proceeding to a limited set of specially identified airports called pacing airports. The real-time input messages are (1) flight plans for nonair-carrier flights proceeding to pacing airports, (2) departure messages for all flights proceeding to a pacing airport, and (3) remove strip messages for all cancelled flights that had planned to land at a pacing airport. The interface with the 20 ARTCC computers is intended to have minimal impact on the existing NAS en route resources. Five of the 20 NAS computers have been designated as store-and-forward focal points to concentrate data from several centers before transmission to the CFCCC. Figure 3-1 shows how a message is forwarded from any ARTCC to the CFCCC.

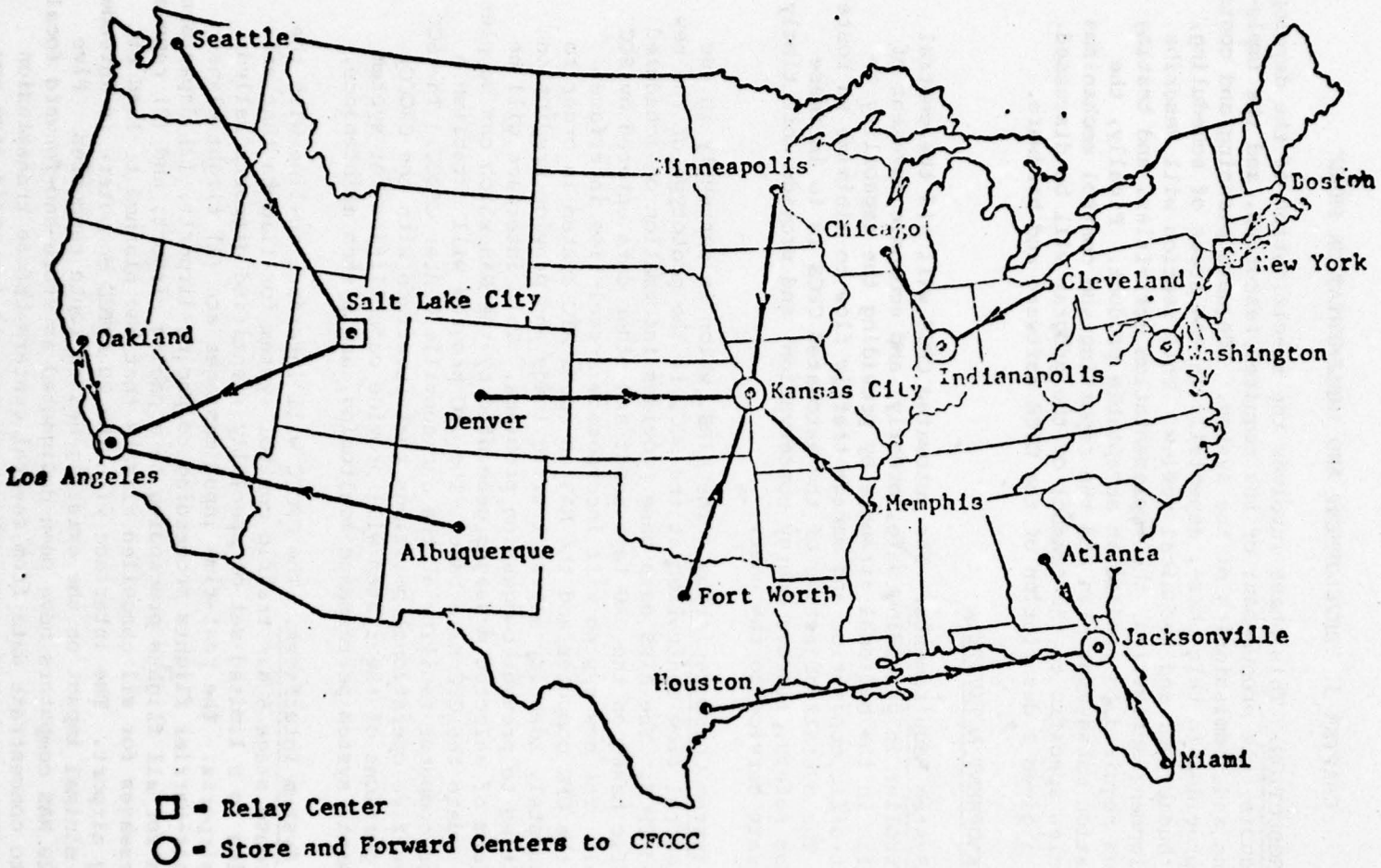


FIGURE 3-1. NAS-CFCCC INTERFACE CONFIGURATION

d. CFC Message Summary. A number of input and output messages have been defined to aid the central flow controller in the execution of his duties. There are five types of message categories: (1) data count - consisting of a number of messages which cause the data base to be searched and specific counts of data to be tabulated, (2) data list messages which cause the data base to be searched and specifically requested data to be listed, (3) simulation messages that cause delay and/or capacity predictions to be computed and tabulated, (4) data base update messages which change or augment the stored data base (one group of these data base update messages is normally entered by flow control personnel and a second group is automatically generated by the NAS en route stage A system - flight plan, departure, and remove strip), and (5) acknowledgement messages consisting of responses to operational messages entered from a central flow control data terminal equipment (DTE) console as an "ACCEPT" message, a "REJECT" message (CFCCC does not accept a message due to computer error, incomplete transmission, etc.), or an error message (CFCCC acknowledges the message receipt but does not accept because of format error). Each message entered from NAS will generate a transmission accepted (DA) or transmission rejected (DR) message in response.

e. CFC System Software. The CFCS software system (operational and support software) and its related activities are organized into three tasks as represented in table 3-1.

(1) Effort will begin on the CFC basic system design review (task 1) and on the CFC operational support system at contract award. Preparation of the PDS will be included in the design effort. After critical design review, the development and compilation of code for the CFC basic system will begin, and work on tasks 2 and 3 will proceed concurrently.

(2) All components of the operational and support software will be implemented in either Jules own version of integrated assembly language (JOVIAL) or basic assembly language (BAL).

(3) A top-down approach will be utilized in design development and a method of traceability will be applied to measure the performance of the functional requirements to the software components.

TABLE 3-1. CFC SOFTWARE MILESTONES

Task 1: CFC Basic System Design Review.

- Prepare Program Design Specification (PDS).
- Critical Design Review.

Task 2: CFC Basic System Implementation.

- Code, Test, Integrate, System Test for the Operational Software.
- Prepare Software Design Data (SDD) Documentation.
- Acceptance Test and Report.
- Executive/Monitor Handbook.
- User's Manual.

Task 3: Operational Support System.

- Develop New Support Software.
- Prepare SDD Documentation.
- Operator's Manual.

f. System Readiness. The Airway Facilities Sectors having purview are responsible for the maintenance of the hardware and software of the CFC system, including equipment within the SCC as well as at the CFCCC. All maintenance activity will be accomplished by the FAA maintenance force consisting of trained technicians and engineers. Due to the ability of the system to operate acceptably in most failure instances, actual maintenance activities can be performed without exceedingly critical timing requirements. Actual maintenance staffing levels for the SCC and the CFCCC facilities shall be in accordance with Order 1380.40. Facility maintenance logs will be kept to provide a complete record of maintenance activities. Form 198, or equivalent, will be used to record all pertinent data regarding the technical operation of the facility.

g. System Operational Standards, Rules, and Procedures. The Systems Research and Development Service will updated Order 7210.76, Flow Control Procedures, date June 8, 1976, where necessary, to include new or supplementary procedures required for the operational implementation of the automated system. ARD will specify standards and procedures for use of equipment, disseminate instructions and information affecting the users, and assure safe and efficient transition to the CFC automation mode of system operation. ARD will also provide the operations requirements and will respond to any planning activities affecting these requirements.

(1) Operational Software. The operational software will functionally interface with the central flow controller in the SCC and directly respond to requests to dynamically adjust system parameters (e. g., landing rates, holding capacities, general aviation factors, and flow control criteria) to generate demand delay, QFLOW and FAD reports; and to disseminate flow control advisories and information messages. Operational software consists of the following subsystems: executive subsystem (EX), applications subsystem (AP), and the data base management subsystem (DB).

(a) EX Subsystem. The executive subsystem will control the hardware, resource management, communications handling, transaction program element dispatching, input/output request servicing, and the relation of logical to physical device assignment. This subsystem will facilitate the separation of a transaction program element's logical view of the system configuration and the physical configuration of the system. Because the applications programs executing under the NAS monitor and those to be developed for CFC share the same real-time requirements and the same multiprocessor machine environment, the EX is to fulfill its requirements using the functions of the current NAS monitor (version A3d2.2). Certain extensions will be necessary for the EX.

(b) AP Subsystem. The applications subsystem will be responsible for all functional message processing (i.e., input message processing, data base retrieval processing, transform processing, data base update processing, and output message processing). AP will facilitate the separation of the subsystems logical view of the data base and system configuration from the physically implemented data base organization and system configuration. The interface with EX will be on a logical request basis, requiring no knowledge on the part of the AP, as to how a service will be requested.

(c) DB Subsystem. The data base management subsystem will be responsible for relating the AP subsystem's logical storage and retrieval requests to specific input/output requests and for the presentation of these requests to EX for servicing. The interface with the EX will be in the form of logical I/O requests that do not require any knowledge of how the request is to be serviced. The CFCS data base will be a collection of global COMPOOLS and disk files, categorized as either static or dynamic. Static data are loaded into core by the system when it is initial program loaded (IPLed) and require no I/O operations to make them available to the CFC software. Dynamic data are stored, retrieved, and updated from disk files, and I/O operation are required to access them.

(2) Support Software. The support software is a collection of functions which stand alone to perform individual capabilities (e.g., testing and source code compilation). The support software will perform the following functions: (1) process input source code for development and checkout of programs (e.g., compiler, assembler, JOVIAL structured formatter); (2) create, modify, and integrate new elements of the operational software; (3) detect and diagnose problems and summarily analyze and report on the performance of the operational software; (4) test, via near real-world simulation processes, the operations of the operational software; (5) monitor and report on the development project progress via effective management-aid processes.

(a) NAS Interface. Much of the existing NAS software will be utilized whenever possible in the development effort required for the support software. Figure 3-2 summarizes the development effort required or the support software.

33. TESTING. Overall test activities leading to commissioning of the CFCS will be coordinated and monitored by the project manager. After factory inspection and testing, system elements will be assembled at each site with appropriate tests and checks at each state of implementation to assure satisfactory interfaces with completed systems during subsequent phases. The equipment and the software will be tested and integrated, and the operational maintenance personnel will be familiarized with the system, including equipment and software.

Support Software Subsystems	Development Required		
	None[1]	Minor[2]	Major[3]
Utilities	○		
Data Reduction & Analysis (DR&A)			●
Static Data Base			●
System Build Group		◐	
System Test Group			●
Management Aids Group		◐	

[1]Software exists and is available for use, requiring no development.

[2]Software exists and is available for use; however, some modification and/or additional development is necessary.

[3]Requirements must be met by completely new developed software or by major modifications to existing software.

FIGURE 3-2. SUPPORT SOFTWARE DEVELOPMENT SUMMARY

a. Performance Measures and Standards. Measures and standards for defining system performance will be a part of detailed system test planning. Each performance measure will be validated in terms of accuracy, precision, meaningfulness, and utility. A standard of performance will be established for each valid performance measure. These performance standards, in turn, will be used during system testing to determine how well the system and/or subsystems are performing its/their functions. During operational readiness demonstration(s), performance standards will be a key test measurement for determining system acceptability. Upon completion of tests, final measures and standards will be established and will become a part of the official facility documentation as a permanent record of the system performance existing at the time of system acceptance for commissioning and will become the basis for the CFCS Maintenance Handbook.

b. System Shakedown. The purpose of system shakedown is to familiarize AT and AF personnel with the integrated hardware and software subsystems. It will be designed to establish operational and maintenance confidence in system operation and to ensure that operational and maintenance procedures with respect to the CFCS will in fact satisfy the requirements for and operational readiness demonstration.

(1) System Shakedown Test Plan. The project manager will develop a system shakedown test plan to provide guidance during the early planning of the system test program. This plan will provide sufficient detail to define and control the development of lower level test planning documentation; it will permit identification and allocation of resources necessary to support and accomplish the test program. The regions will be responsible for developing detailed procedures which will be required at their respective facilities for the conduct of testing in accordance with the system shakedown test plan.

(2) Prerequisites. The basic prerequisites for the start of system shakedown are as follows:

(a) The system will have demonstrated to compliance with all technical and functional requirements of the specifications and amendments, if any.

(b) The appropriate FAA operational personnel will have completed training and proficiency development in the operation of the system.

(c) FAA maintenance personnel will have completed the required training and achieved proficiency in system maintenance procedures.

(3) Operational Readiness Demonstration (ORD). The activities during the system shakedown phase will be directed toward bringing the total system, including personnel and procedures, to a state of operational readiness. System shakedown will culminate in an ORD which will consist of operational and maintenance tests to show that necessary performance standards have been met and that the system is in fact ready for operational use. The successful completion of ORD is the point at which the project manager will turn the system over to the user for operations changeeover.

34. IMPLEMENTATION PLAN.

a. System Establishment Responsibilities. The CFC automation establishment responsibility is broadly categorized into four major activities: contractor supplied system elements, modifications to existing equipment, scheduling, and testing.

(1) Contractor-Supplied System Elements. At the CFC facilities (SCC and CFCCC) when contractor-supplied system elements are required, these elements will be sent to and received at the site(s) by contractor personnel. Uncrating and equipment placement will be accomplished by contractor personnel. It will be necessary for the contractor to coordinate this activity with the facility OER. Equipment not scheduled for immediate installation and checkout will be moved to an intermediate storage area. When an intermediate storage area is not available, the contractor will secure space prior to equipment delivery and may request assistance from the OER in locating space.

(a) A selected contractor will be responsible for the installation of the DTE portion of the system. This will include all signal cabling between the DTEs and the Modulator-demodulator/multiplexer (MODEM/MUX) and the communications modem equipment. All other installations will be accomplished by appropriately designated FAA regional personnel.

(b) The DTEs will be installed in the SCC operations room when they are required to meet the in-service change requirement of the program. All DTEs phased into operations will be certified for use in all operational modes and will require at least one certified backup display.

(c) Onsite Airway Facilities personnel will be responsible for replacing a failed DTE with a backup DTE. Repair work on a backup DTE will begin within 24 hours after its failure and will be completed or replaced with another conditionally accepted backup display.

(2) Modifications to Existing Equipment. Modifications to existing ARTCC computer equipment at the store-and-forward centers will be necessary to provide an interface with the CFCCC at Jacksonville. These modifications will consist of the installation of peripheral adapter module (PAM) adapters and modems.

(3) Scheduling. Current plans call for the majority of onsite installation and checkout work at the affected ARTCCs to be done by the local ARTCC maintenance staff, with some exceptions possibly at the CFCCC at Jacksonville. It is anticipated that most of this installation/checkout activity in the respective ARTCC equipment rooms will be done during normal working hours. The actual tie-in with operational/existing systems (e.g., ARTCC central computer complexes, etc.) and a few critical tasks in the equipment room(s) may have to be accomplished at night to minimize the possibility of disrupting site operations.

(a) Facility operations and technical personnel will determine the optimum tie for such installations/connections, since it might be necessary to schedule down time.

(b) It is anticipated that much of the work in the ARTCC and the SCC operations quarters will be done during the midnight shift. The working hours will vary, depending upon the traffic load and the available space in the operations quarters; it is mandatory that the work be done in accordance with a mutuallly agreed upon schedule between regional maintenance and operations management personnel.

(4) Hardware Testing. Onsite implementation and testing will first involve the physical installation of system equipment and static electrical checks of the system elements plus subsequent use of offline diagnostic programs. Some diagnostic programs have yet to be developed by the software contract. A final system test will be made which includes a check of operating controls and the operational software. After satisfactory completion of this testing phase, IOC of the automated CFC system will be attained. Technical as well as operational guidance will be required during this phase.

b. Regional Establishment Responsibilities. The regional SCC automation establishment responsibility is broadly categorized into four major activities: site implementation plan, regional engineering, site preparation work, and contractor related work (i.e., monitoring respective contractors' activities and providing assistance to them in the interest of accomplishing the work in a correct, expeditious, and non-disruptive manner).

(1) Site Implementation Plan (SIP). An individual SIP will be developed by each region whose ARTCC(s) are involved in the CFC automation program (namely the Eastern and Southern Regions). Each SIP will consititute an expansion of this SPP providing comprehensive coverage from the general descriptions down to the required particulars (as necessary) to ensure successful implementation of the program at each affected ARTCC and the respective automated CFC system site. The SIP will contain specific requirements, functions, and program direction peculiar to each site such as hardware, software, manpower, interfaces, configuration, and integration.

(2) Regional Engineering.

(a) Preparation of Cost Estimates. Regional estimates for costs associated with CFC automation implementation will be documented by each affected region and submitted to AAF-600 for approval and fund allocation, as appropriate.

(b) Government Furnished Equipment (GFE) Requirements. Each affected region will establish requirements for any necessary GFE and other material for CFC automation establishment/implementation at each affected facility.

(c) Engineering Activities. Affected regions are responsible for all normal engineering activities; i.e., preparation of drawings, work orders, and contracts for site preparation work.

(3) Site Preparation Work. Regional responsibility for preparing the appropriate site(s) includes providing demarcation junction box, AC power circuits, cable baskets, ladders, and conduits between the displays in the control room, equipment room, and any other environmental modifications (i.e., desks, workspace, etc.) as required. The preparation of a preliminary installation plan for each site will be the responsibility of each affected region and the SCC site at FAA headquarters. Plans will consist of technical information such as equipment and control room floor plans, cable length requirements, cable routing, AC power information, operational data, etc. Required modifications will be made to existing FAA equipment located at the site before CFC automation equipment delivery. All equipment modifications required for implementation shall be accomplished in accordance with approved published procedures.

(4) Contractor Related Work. A local contact designated by the region will be responsible for coordinating with the facility OER on a regular basis to:

(a) Provide any necessary coordination between the contractor and the activities of the facility.

(b) Monitor contractor "onsite activities" to assure adherence to the schedule in accordance with provisions of the contract.

(c) Provide assistance to the contractor as needed in order to accomplish the timely installation and checkout of the entire CFC automation system.

c. Environment.

(1) Automation Equipment Floor Space Requirements.

(a) SCC. The Air Traffic Control System Command Center will require approximately 300 square feet of floor space for the automated CFC system elements at FAA headquarters. This estimate includes access space to the equipment and sufficient aisle space for test equipment.

(b) CFCCC. This facility at the Jacksonville ARTCC (Hilliard, Fla.) will require approximately 6000 square feet of floor space for the automated CFC system elements, including access space to the equipment and sufficient aisle space for test equipment.

(c) ARTCCs. The five ARTCCs which will interface with the CFCCC (Los Angeles, Kansas City, Indianapolis, Washington, and Jacksonville) will require floor space for the addition of two interfacility data set (IFDS) modems.

(2) Power Requirements. The CFC computer (9020A) will be moved from its present location within the Jacksonville ARTCC into an adjacent building. The anticipated CFC system automation power requirements for the equipment and operations room(s) are as follows:

(a) ATC System Command Center. Operations room - 120 volts, 1 phase, 4 kilowatts.

(b) CFCCC Facility. Equipment room - 208 volts, 3 phase, 125 kilowatts.

(3) Air Conditioning Requirements. Anticipated air conditioning requirements follow:

(a) ATC System Command Center. No change.

(b) CFCCC Facility. 325,000 BTU/hr.

(c) ARTCCs. No change.

d. Security.

(1) Scope. The CFC procurement does not require access to classified information by the contractor or any of his employees. The contract is not considered a CLASSIFIED contract within the meaning of Order 1600.2A, Classification, Reclassification and Control of National Security Information, dated February 13, 1973. The contract document is UNCLASSIFIED and it is planned that:

(a) Hardware and software furnished by the contractor will not be assigned a security classification.

(b) Security clearances will not be required (under normal peacetime operations) by contractor personnel since no military data or access to military installations will be required.

(c) FAA/DOD industrial security program requirements will not be appropriate.

(2) Physical Security Requirements. Integrity of the CFC data base will be ensured since access will be limited only to authorized personnel who have responsibility for its maintenance. Direct access to the data base via computer terminals from remote locations will not be permitted. Physical security of the CFC system will be ensured by its location within an FAA operated facility and will be subject to the security procedures for that facility; i.e., FOB-10A or JAX ARTCC.

35. CONFIGURATION MANAGEMENT PLAN

a. Configuration Management Organization and Functions. Configuration management is accomplished by the configuration management staff (CMS) in conjunction with the appropriate configuration manager. Configuration management is established to achieve the following objectives as further detailed in FAA Order 1800.8D, NAS Configuration Management:

(1) To establish and maintain an approved baseline configuration for subsystems comprising the national airspace system.

(2) To provide management of changes to baselined end items taking into account need, cost effectiveness, and schedule impact.

(3) To assure that all deliverable end items achieve the optimum degree of uniformity consistent with the program and are accurately described by proper documentation.

(4) To provide status accounting of configuration management actions.

b. Configuration Management Procedures. Utilization of the configuration management process and functions for the CFCS are required to ensure proper control of the national system of integrated hardware and centralized computer programing. The CFC system has been accounted for in three management directives.

(1) NAS ATC Subsystem Baseline Configuration, NAS-MD-001. The baseline configuration is a listing of end items which have been determined to be subject to configuration control. The automated CFCS has been added to NAS-MD-001 and, therefore is not changeable without the concurrence of the Configuration Manager.

(2) Configuration Identification Documentation Listing, NAS-MD-002. The configuration identification documentation listing is a document that defines end item(s) and represents the level of control that will be exercised over each of the end item(s). The CID list is dynamic in that it changes as end item implementation progresses. For example, initially a piece of equipment might only have the procurement specification on the CID list. As the implementation progresses, the design data would be added, and then the unit, user's manual, parts list, etc. It is essential that all changes and corrections be made and recorded and the status of present units be known so that future system improvements can be implemented; the CID listing of each end item provides this information.

(3) Summary List - NAS Change Proposals (NCPs) and Configuration Control Decision, NAS-MD-003. This status accounting document establishes and maintains a complete accounting system for all end items under the control of AAF-40. NAS-MD-003 will correlate CFCS change proposals (NCPs), configuration control decisions (CCDs), electronic equipment modifications (EEMs), case file numbers, and end item numbers. This directive will include all affected sites.

36. TRANSITION PLAN. Operations changeover is the phase of implementation when the automated CFCS is phased into daily on-going air traffic control operations on a nationwide basis. The development of the operations changeover plan will be coordinated by the project manager. It will be completed prior to start of system shakedown to permit testing or validating of procedures and operations included in the plan. This operations changeover plan will include, for example, the procedures, scheduled phases and changeover techniques, necessary coordination, and training requirements for phasing the automated CFCS into ongoing operations.

37. REPORTING AND CONTROL. See section 23 for the organizational structure which will be utilized for maintaining internal project management visibility and control during the development and implementation phase.

38-40. RESERVED.

CHAPTER 4. OPERATIONS AND MAINTENANCE PHASE

41. INTRODUCTION. This phase involves the provision of required services and facilities, the performance of routine system maintenance, and the measurement of actual versus expected performance. This section will discuss the overall maintenance concept, the spare parts and provisioning plans, the requisites and objectives of training, the staffing changes resulting from system implementation, and the plans and requirements for a system audit.

42. MAINTENANCE CONCEPT. The major goal for the maintenance growth rate management program is an overall balance in the recurring operational budget.

a. Efficiency of design for maintainability and reliability shall be a major feature of the complete system. Every piece of hardware and every software program shall be justified at various stages of development and testing with these objectives in mind.

b. The functional service availability will be failsafe up to 100%. The availability of single thread equipment providing communication functions will be about 99%. In addition, the monitoring system will provide adequate advance notice of failures and the rerouting of service to dual/alternate paths to assure the failsafe availability of the service function. The elements or components that can cause a failure of any single thread equipment path will have a specified combined mean time between failures (MTBF) approaching 50,000 hours, including the complete power subsystem.

c. The system shall be designed to require minimum preventive maintenance on a scheduled basis. However, scheduled operational checks are recommended to preclude undetected failures which could go unnoticed until the circuit or equipment is needed. Daily, weekly, monthly, and semiannual operational exercises will be developed and presented in the CFCS instruction book to insure maximum performance and availability.

d. Since the CFCS will be designed "failsafe", corrective maintenance can be deferred until activity workload will permit troubleshooting and diagnosis. FAA technicians are encouraged to reconfigure the CFCS to the highest level possible consistent with the unique failure. This reconfiguration should be accomplished immediately after the malfunction is detected.

e. The system monitoring capability shall permit isolation of faults to the functional element. Corrective maintenance of the display, system console, and printers will be to the component level.

f. The use of diagnostic software will be limited to properly trained facilities personnel. All diagnostics furnished as part of the CFCS will be documented with listing and operator instructions and will include a listing of all responses expected and functional areas in which problems are located.

43. SPARE PARTS PROVISIONING.

a. Logistic Support. The logistic support process for CFCS will be a continuing activity, beginning in the earliest phase of the acquisition process, with development of the maintenance/support concept. The intent of this early planning is to influence the design of the end item and provide an orderly collection of data for use in determining logistics requirements for CFCS. The individual item quantity requirements are to be predicated on a maintenance/support concept based on operational considerations, equipment redundancy, and reliability factors derived from the approved system design and announced by the Airway Facilities Service. Storage space is to be provided for supply stock and is to be planned by the regional office responsible and coordinated with ARD, AAF, and ALG during the logistics support phase of the system design for each facility being implemented.

b. Supply Support.

(1) Long Lead Time Items List (LLTIL). In order to obtain timely delivery of items having a long procurement lead time, the FAA Depot is to utilize an LLTIL parts list furnished by the contractor. At least 30 days prior to his planned procurement of production parts, the contractor is to submit the LLTIL to the agency. The FAA Depot is to use the list to identify those long lead time items which should be placed on order prior to receipt of the provisioning parts list.

(2) Provisioning Parts List (PPL) and Numerical Parts List (NPL). A tabulation of all replaceable parts and assemblies used in the end article subject to electrical or mechanical failure is to be furnished by the contractor. These listings shall be prepared in accordance with Specification FAA-G-1210c, dated April 13, 1971. The PPL and NPL are to be delivered within 90 days after contract award.

(3) Item Identifications/Item Logistics Data Records. The contractor shall furnish item identifications/item logistics data records in accordance with FED-STD-5 for each item in the provisioning parts list(s) for which the FAA states a requirement.

(a) Provisioning Conference. A provisioning conference chaired by the contracting officer, as requested by the FAA Depot, is to be held approximately 30 days after receipt of the PPL.

(b) Initial Stock Requirements. Approximately 60 days after the provisioning conference, the FAA Depot is to determine initial stock requirements for the FAA Depot and user points and initiate appropriate acquisition action. Requirements for each spare part and assembly to be acquired by an appropriate CFCS contract modification are to be expressed and met through the contracting officer.

(c) Notification of Contractor. At the time the Government gives the contractor notice to proceed on each of the follow-on year productions, the contractor is to be notified of the spare parts to be provided in that year.

(4) Replaceable Modular Circuit Board Sets. The contractor is to provide one set of spare modular circuit boards with each CFCS. The number of spare circuit boards comprising a set are to be equal to 10% (rounded to next higher whole number) of the total quantity of *each type used,* but not more than 10 and not less than one. Delivery is to be before the installation and checkout date of the system being supported.

c. Requisitioning Initial Supply Support Items. Order 4620.3B assigns responsibility to the FAA Depot to establish initial supply support allowance charts (ISSAC) and maintain adequate stock to support new or modified equipment installations.

(1) Submission of FAA Form 4500-2. Regions are to submit FAA Form 4500-2 to the FAA Depot, in accordance with paragraph 71, Handbook 4650.7, to obtain FAA Depot mechanical preparation of FAA Form 4250-3 requisition and requisition suspense cards and delivery of ISSAC items. The FAA Form 4500-2 for each facility should identify the number and type of equipment to be supported. The forms should be forwarded to the FAA Depot not later than three months prior to the schedule date of final acceptance of the CFCS at the site and FAA assumption of supply support responsibility.

(2) FAA Depot Procedures. The FAA Depot is to use procedures in paragraph 33, Handbook 4250.9, to furnish stock items and the associated requisitioning forms. ISSAC items must be received onsite before the scheduled date of the joint acceptance inspection.

d. System/Equipment Instruction Books. Two copies of instruction books are to be provided and delivered with each system. Ten copies will be provided to the FAA Depot and one copy to the applicable regional office. These instruction books will document for easy access the necessary information on system, subsystem, and equipment unit levels.

e. Tools and Test Equipment. All special tools and test equipment necessary for the installation, repair, adjustment, test, and maintenance of the CFCS not readily available on the open market, are to be supplied by the contractor with the equipment.

(1) Schedule A Items. The contractor is to submit a list of recommended schedule A supplies and working equipment to the FAA in sufficient time to allow headquarters review. Procurement action for items readily available on the open market (or through Government procurement sources, i.e., GSA) is to be initiated as soon as possible so that those items are onsite prior to the installation and checkout phase.

(2) Standard Test Equipment. The contractor also is to provide a list of standard test equipment which is required to maintain the system.

(a) The contracting officer is to obtain agency review of lists furnished by the contractor.

(b) Standard test equipment required for support of the CFCSs is to be provided in accordance with Agency Order 6200.4A, Test Equipment Management Handbook.

44. TRAINING OBJECTIVES.

a. Introduction. This section identifies training requirements for personnel who will be engaged in the management, testing, operation, and maintenance of the central flow control automation system.

b. Training Programs. The CFC automation training program will consist of a combination of FAA Academy and contractor conducted training. This section describes the training programs planned for operations and maintenance personnel at the SCC and CFCCC facilities. Training programs for the CFC automation system will be provided for ATC ATC operational personnel and Airway Facilities maintenance personnel.

(1) Operational Training.

(2) System Software Training

(a) The software training is divided into two phases. The first phase consists of Course 53126, IBM 9020 Computer Programmer, Conducted by the FAA Academy in Oklahoma City, starting in June 1977 for 8 weeks.

The second phase is a contractor developed and conducted software course. The primary purpose of this course is to train the software specialist on the computer program to be utilized with the 9020A system.

Prerequisite for this course is Course 53126 or its equivalent. Training outcomes are that all software personnel shall be able to:

1 Describe the overall system structure of the CFC operational program.

2 Explain basically how the applications and functions of the CFC hardware and software system satisfy flow control operational requirements.

3 Interpret the operational program flow charts.

4 Locate the interpret all routines in the program listings, using the program flowcharts as a guide.

5 Utilize all operational messages that control the CFC operational system.

6 Detect abnormal computer software operation and initiate corrective action.

7 Demonstrate an understanding of the CFC operational support system.

8 Demonstrate an understanding of the CFC utility system and processors to the extent required to correctly generate an input to the CFC system tape edit program.

9 Execute program dumps and debug the operational program and make necessary software modifications to the CFC operational program.

10 Explain supporting documentation and its use.

(3) System Hardware Training for Operational Personnel

The initial requirement to utilize input/output devices and messages will be satisfied by the contractor course for data systems personnel; training for operational personnel will not be needed until a later date. When this training becomes necessary, the data systems personnel will develop and conduct the courses for the operations personnel.

The CFC input/output devices will be Data Terminal Equipment (DTE). Training on these devices will be accomplished by a short Academy developed directed study or briefing package, rather than a formalized training session.

(4) Maintenance Training

The Airway Facilities personnel (3 people) responsible for CFC maintenance (headquarters) will need to be trained on peripheral devices. These devices include DTE, Modems and Tape perferators. This training is available on a continuing basis. The six Airway Facilities technicians responsible for CFCCC maintenance (Jacksonville) will need to be trained on 9020A and its peripheral devices. Training will also be required on perallel-serial conversion equipment (PSCE). Since the latter is a unique item, this training should be obtained from the contractor. It is also anticipated that there will be a software training program for the Systems Performance Officer (SPO) and Systems Performance Specialist (SPS) as well as computer operator traning for the computer system operators.

45. MANPOWER REQUIREMENTS.

a. Scope. This section provides preliminary manpower planning guidance and estimates for the operation and maintenance of the CFCS. Data are based upon information supplied by offices and services and includes considerations involved in the interface with other aspects of the agency's en route automation program. The data herein are essentially for planning purposes, and further modifications can be expected as the program develops. Maintenance and central flow control positions will be classified locally on the basis of the current Civil Service Commission classification standards and FAA guidelines. Regional office(s) should direct any inquiries regarding interpretations of these standards and guidelines, or other position classification questions requiring action by FAA headquarters, to the Office of Personnel and Training.

(1) Selection Guides and Procedures. Employee assignments to this program will be in accordance with the provisions of Civil Service Commission Handbook X-118. Administrative reassignments may be made in accordance with Internal Placement Handbook PT P3330.9. All other selections of agency personnel will be in accordance with the FAA's merit promotion plans.

(2) Staffing. The staffing guides provided herein are predicated upon the level of annual instrument operations for the air traffic control data systems staff and a 16-hour day, 7-day per week requirements for maintenance.

b. Requirements. Data contained in this section are to be used for planning purposes in determining the need for additional positions or funds that may be required by the implementation of CFC automation. Affected offices, services, and regions will utilize normal budgetary procedures and funding increases. Appropriate regional officials are, however, the final authority on their budget submissions. Region and center directors will effect manpower adjustments without staffing and funding additions when this can be accomplished without an adverse impact on employees and programs. Should placement assistance be necessary, directors will utilize the procedures outlined in Handbook 3200.3, Manpower Planning Program, and if necessary, Handbook 3350.2, Staffing Adjustments.

c. Air Traffic Structure. Staffing for the CFCF is considered an augmentation to the existing personnel resources at the SCC and CFCCC facilities. Additional air traffic (AAT) control specialists that may be required will be data systems officers and data systems specialists.

d. AAF Organization Structure. Staffing for the maintenance of the automated CFCS is considered an augmentation to the existing maintenance capabilities at SCC and CFCCC facilities. Maintenance position descriptions for both facilities should be reviewed for compatibility with the 1972 DOT Electronic Maintenance Technician Classification Guide. The SCC facility will be maintained by AF sector field office 832.2, which also maintains the Command Control Center, the Telecommunication's Center, the Central Altitude Reservation Facility, and the Accident/Incident Analysis Center; all are located in FOB-10A, FAA headquarters.

e. SCC Staffing Requirements.

(1) One supervisory air traffic control specialist (data systems officer), GS-2152.

(2) One air traffic control specialist (data systems specialist), GS-2152.

(3) Three AF electronics technicians, GS-856.

f. CFCCC Staffing Requirements.

(1) One supervisory air traffic control specialist (data systems officer), GS-2152.

(2) Three air traffic control specialists (data systems specialists), GS-2152.

(3) Ten AT computer programers, GS-334.

(4) Two AF System Performance Specialist (GS-855/856).

(5) Six AF electronics technicians, GS-856.

(6) Five AF Computer System Operators (GS-334).

(7) One AT keypunch/steno/lib.

(8) One AF Staff Engineer (GS-855).

g. FAA Academy Instructor Requirements. Additional instructor staffing at the FAA Academy to support the CFC automation program is not anticipated. However, the present air traffic control training course content and materials may require augmentation to include techniques and procedures for the coordination and interaction of the SCC central flow controller(s) and the ARTCC local flow controllers. The director of the Aeronautical Center (AAC-1) in coordination with the Office of Personnel and Training is responsible for the implementation of appropriate training course changes which may be required to support the approved training programs for the CFC automation system.

46. SYSTEM AUDIT PLAN. This activity involves the measurement of system performance with respect to established system criteria and the recommendation of improvements in the system and the systems development function in general. The points to be addressed in this plan should include:

a. Evaluation of the system versus the requirement following operational commissioning.

b. Measurement of the tangible benefits actually obtained.

c. Measurement of actual development, maintenance, and operating costs.

d. Assessment of the intangible benefits obtained.

e. Determination of what phases of the general development procedures need strengthening.

f. Determination of the success of the systems concept employed and a recommendation on its future usage.

g. Recommendation whether future phases of the system should be approved.

47.50. RESERVED.

CHAPTER 5. PROGRAM MANAGEMENT

51. INTRODUCTION. This section will provide the detailed plans, audit trails, and status of the program. It will describe the program milestones, program status reports, and the mechanisms for documenting changes in the program.

52. MILESTONES. The program milestones are the program manager's summary of the vital parts of the program. Figures 5-1, 5-2, and 5-3 represent the plan for production of the products of the program. These are intended to be used as a common means of communication among all management elements.

53. STATUS REPORTS. This subsection will be used for documenting program status, progress, and problems on a periodic basis in accordance with the mechanics and forms described herein. The points to be covered by this section should include at least:

a. Overall assessment of status.

b. Evaluation of technical performance.

c. Evaluation of cost.

d. Major achievements since last report.

e. Expected achievements in next reporting period.

f. Key problem areas.

g. Funding status.

54. MECHANISM FOR CHANGE. The criteria and procedures for instituting major changes to the CFCS program structure are documented in Order 1800.8D, National Airspace System Configuration Management. The order describes the means for proposing a change to an end item through a NAS change proposal (NCP) and the means of recording and reporting proposed changes to end items and subsequent actions, known as configuration status accounting.

55.-60. RESERVED.

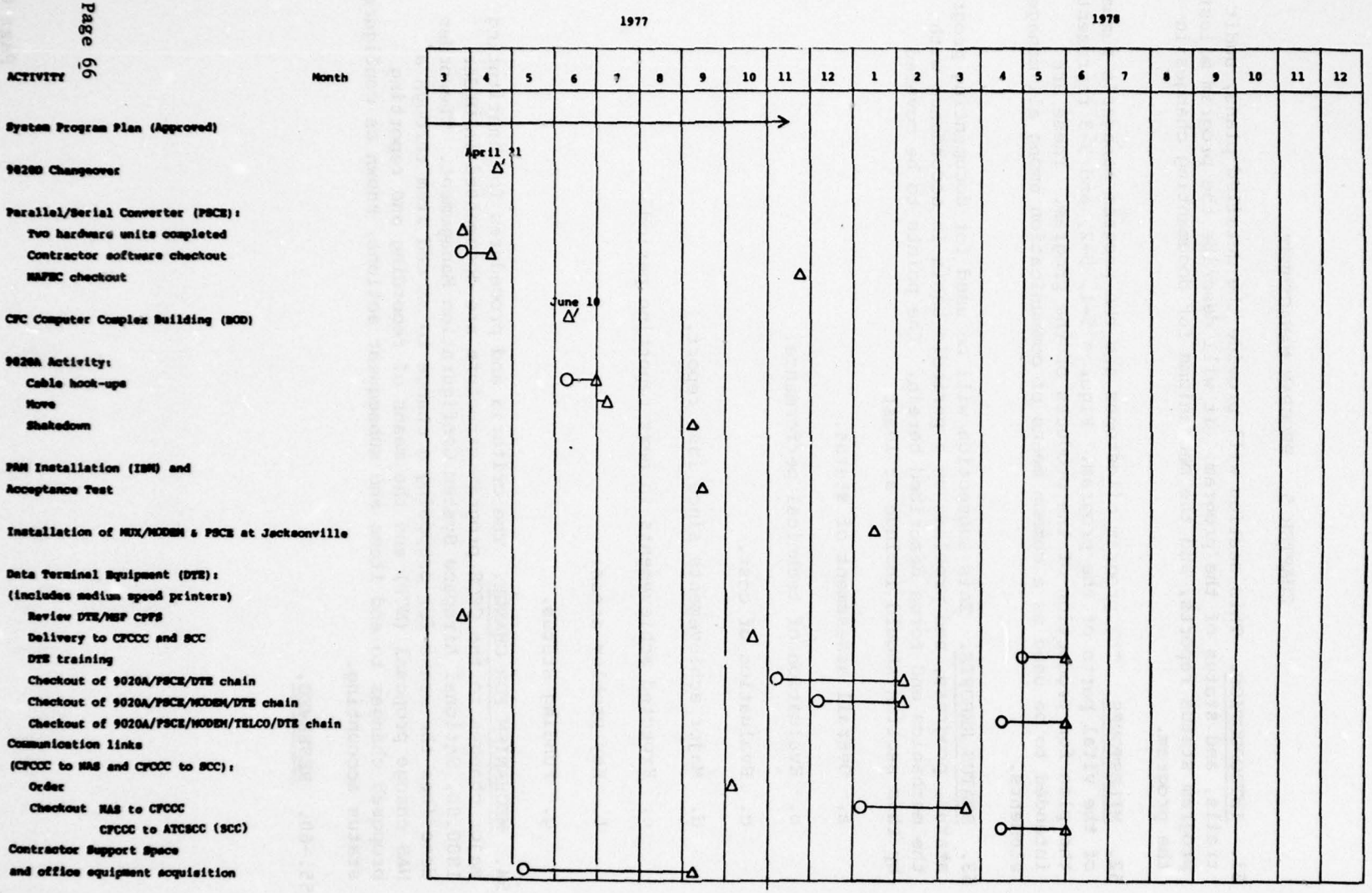


FIGURE 5-1. CFCS HARDWARE MILESTONE CHART

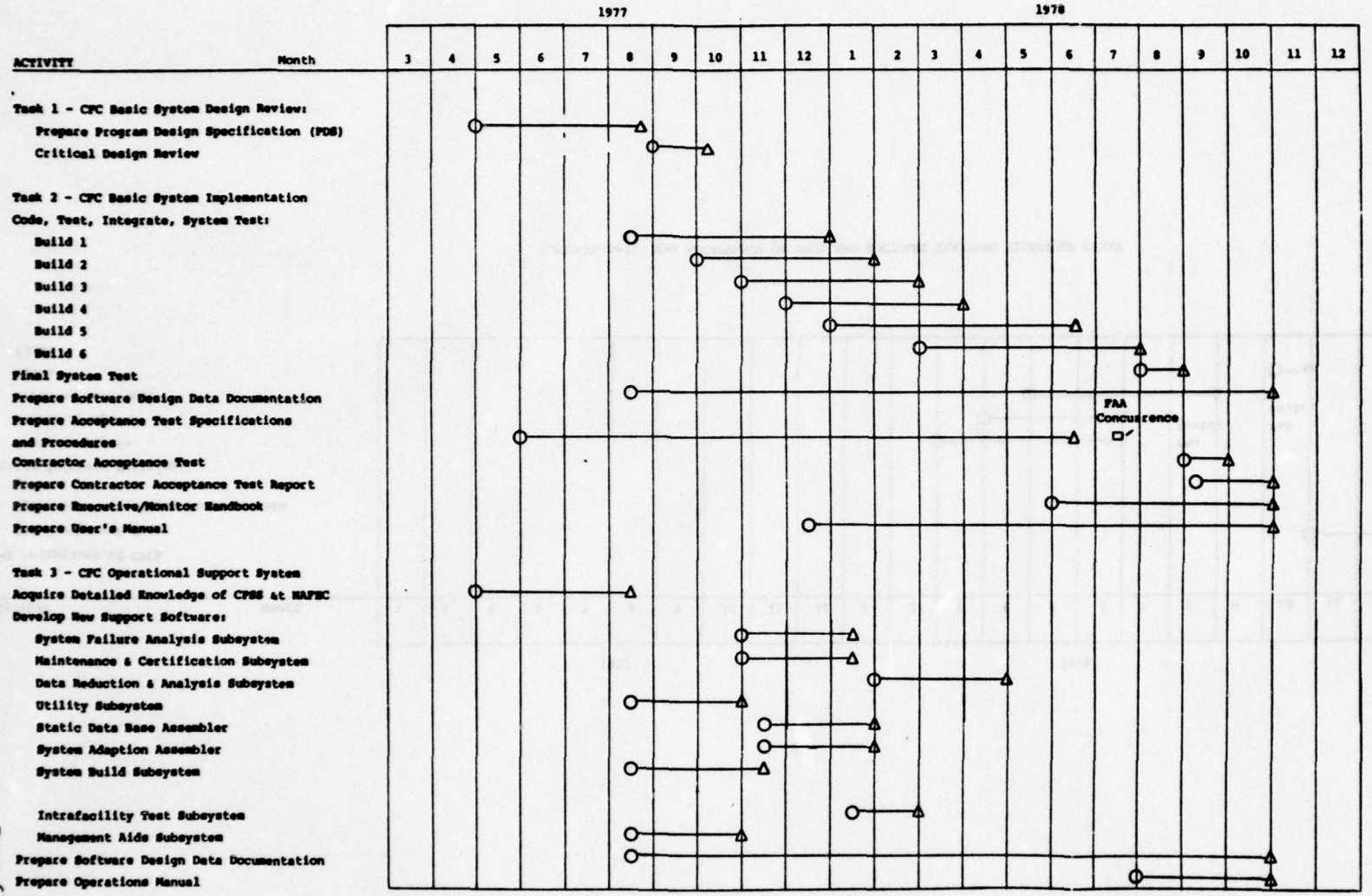


FIGURE 5-2. CPCS CONTRACTOR SOFTWARE MILESTONE CHART

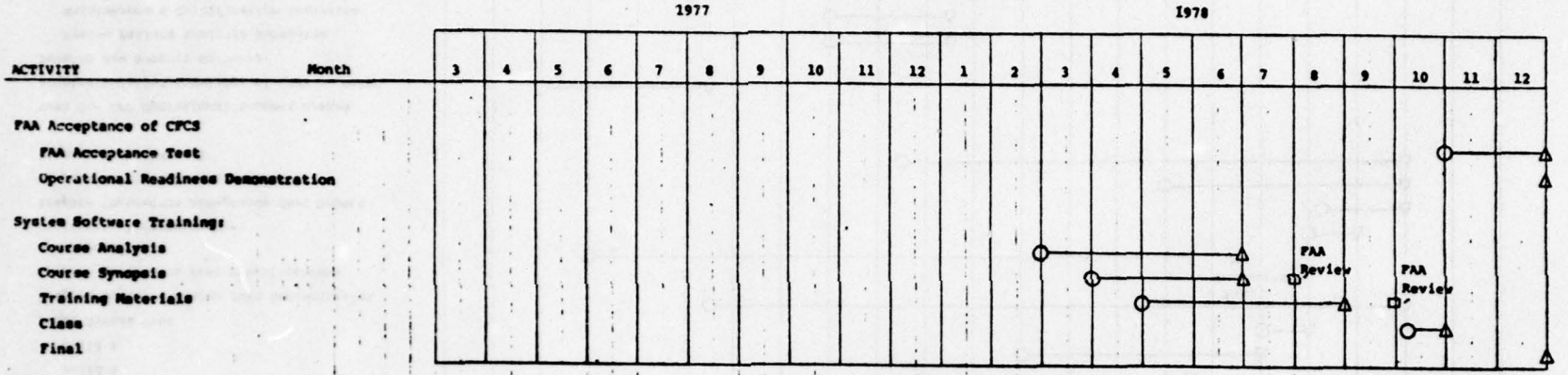


FIGURE 5-3. FAA ACCEPTANCE OF CPCS AND SOFTWARE TRAINING MILESTONE CHART

APPENDIX 1. CFCS HARDWARE AND SOFTWARE DESCRIPTION

1. SYSTEM HARDWARE.

a. SCC Hardware. The SCC will have five central flow control positions. Each position will be equipped with standard data terminal equipment (DTE). The complete DTE set consists of a printer, a keyboard/display for data entry and readout, a controller with line buffering, and a journal.

(1) Additional hardware in the SCC includes two medium speed printers (3600 bit/sec., 200 lines/minute) and two five hole paper tape reperforators (75 bit/sec.). Only one medium speed printer and one paper tape reperforator will be used operationally with the extra devices serving as maintenance spares. This equipment is interfaced with the CFCCC through two 4800 bps data modems with a redundant modem. The communication lines will have direct dial backup.

(2) Table A-1 provides a summary of equipment located at the SCC which is used in support of the central flow control function.

b. CFCCC Hardware.

(1) Online Hardware. The CFCCC system consists of an IBM 9020A with peripherals. Table A-2 summarizes the hardware equipment and figure A-1 represents the data processing configuration. The DTE console and paper tape reperforator will be used for system checkout and for the operational system monitor. The DTE console will be uniquely addressable.

(2) Offline Hardware. Table A-3 sumarizes the offline CFC system hardware. All elements in the offline system will be available for configuration into the online system on demand.

(3) Communications Interfaces.

(4) SCC-CFCCC. The interface between the SCC and the CFCCC will accomodate data transmission over two 4800 bps channels. These channels will be dedicated two-point voice grade. One channel will contain the bit stream consisting of multiplexed signals of four DTE terminals at 1200 bps and the TTY at 75 baud. The second channel will contain a bit stream consisting of multiplexed signals of the fifth DTE terminal at 1200 bps and the high speed printer at 3600 bps.

1 The multiplex/modem equipment includes 8 bit serial (ASCII) to 9 bit parallel (IBM) connectors for getting data into the 9020A and 9 bit parallel (IBM) to 8 bit serial (ASCII) converters for getting data out of the 9020A and into the 4800 baud line. Both 4800 baud lines have this data format conversion capability.

TABLE A-1

SCC Hardware

for the

Automated Central Flow Control Function

Hardware Elements	Quantity
DTE central flow control consoles, including:	5
a. Low speed console printer	
b. Display monitor (CRT)	
c. Keyboard	
d. Line buffered controller	
e. Journal (magnetic recording/playback device)	
Medium speed printer	2
Five hole paper tape reperforator	2
Modem rack	1
a. 3 - 4800 BPS modems	
b. 2 - patch panels	
c. Associated power supplies	

TABLE A-2

CFCCC Online Hardware

for the

Automated Central Flow Control Function

Hardware Elements	Quantity
Computing element (7201-01)	2
Input/output control element (7231-02)	2
Storage element (7251-08)	5
Peripheral adapter module (7289-02)	1
Tape control unit (2803-01)	1
Tape drive (2401-02)	3
System console (7265-02)	1
Disc control unit (2314-A1)	1
Disc drive (2318)	4
High speed printer - 600 line/min. (1403-02)	1
Integrated control unit (2821-1)	1
Printer keyboard (I/O typewriter) (1052-07)	2
DTE console	1
Five hole paper tape reperforator	1

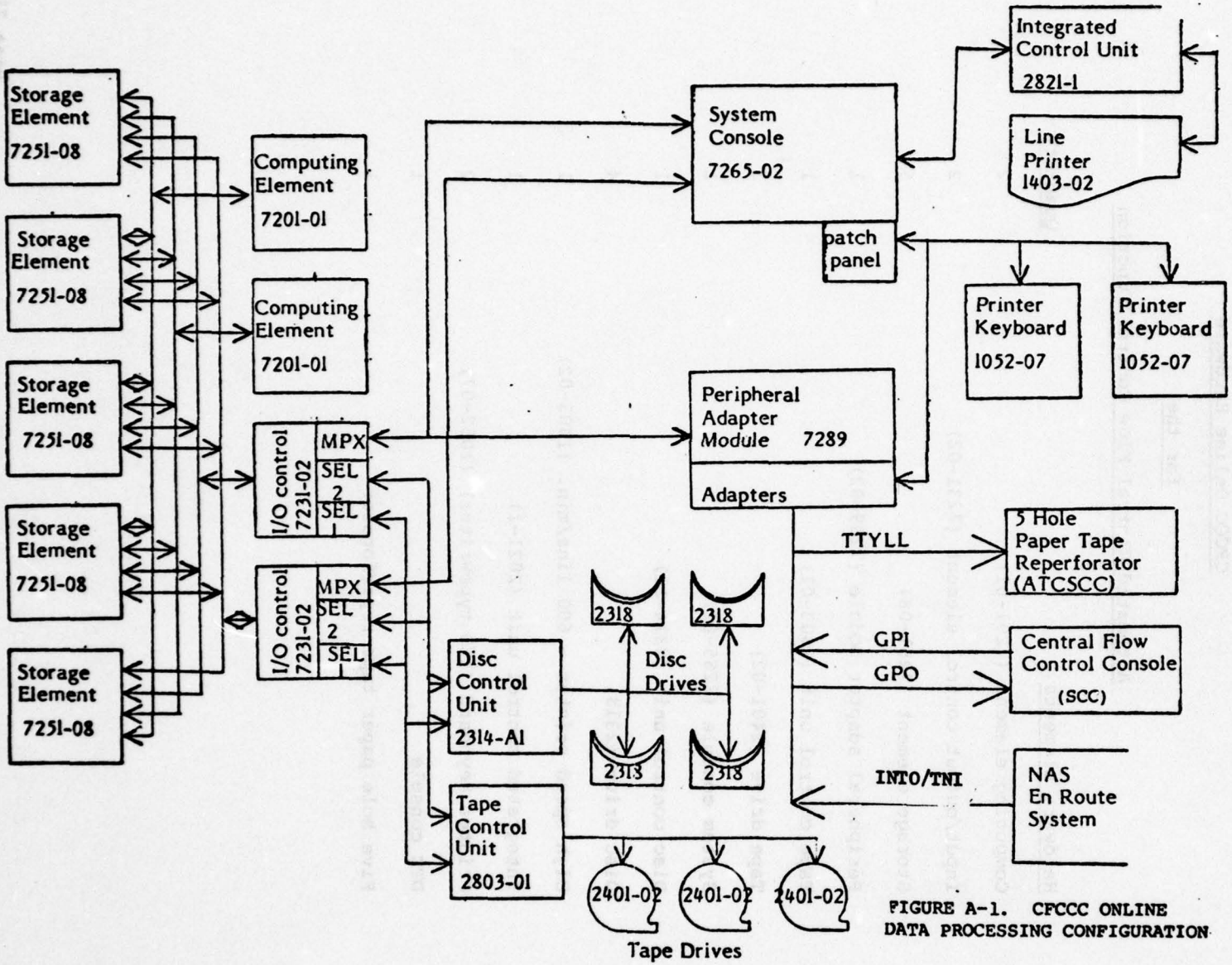


FIGURE A-1. CFCCC ONLINE DATA PROCESSING CONFIGURATION

TABLE A-3

CFCCC Offline Hardware

for the

Automated Central Flow Control Function

Hardware Elements	Quantity
Computing element (7201-01)	2
Input/output control element (7231-02)	1
Storage element (7251-08)	6
Peripheral adapter module (7289-02)	1
Tape control unit (2803-01)	1
Tape drive (2401-02)	4
Disc control unit (2314-A1)	1
Disc drive (2318)	7
High speed printer - 600 lines/min. (1403-02)	1
Integrated control unit (2821-1)	1
Printer keyboard (I/O typewriter) (1052-07)	1

2 General purpose input/output (GPI/GPO) adapter pairs used with the PAM interface the DTE terminals with the model 9020A CFCCC.

3 The interface for the teletypewriter is a long line adapter (TTYLL). Each character is received or transmitted bit serially using a baudot start/stop transmission code at 75 bps.

4 Figure A-2 illustrates the SCC-CFCCC interface configuration. The modems are 4800 baud with automatic and adaptive equalization so that they can operate over unconditioned telephone circuits including the direct distance dial (DDD) network. The modems operate over the frequency range 900-2500 Hz with the equalizer overcoming the effects of large variations in amplitude and delay distortion. The multiplexer can be used in a number of port configurations but, as shown in the diagram, is run with four channels at 1200 baud each. All data sources are synchronous and connected to the modem by separate interfaces. The TTY is multiplexed on a secondary independent asynchronous channel on the low frequency guard baud. Figure A-2 also indicates a dual dialup capability. With this arrangement, the modem can be switched from its private, dedicated line to transmission over the DDD network when connected via a data access arrangement (DAA). The DAA is a direct electrical connection with the user supplying the modem. This capability provides communication backup should the dedicated line be lost. Table A-4 summarizes the equipment requirements for the SCC-CFCCC interface.

(b) NAS-CFCCC. The interface between the CFCCC facility and the NAS en route system will accomodate data transmission over five 2400 baud channels. These channels will be simplex with 600 ohm unconditioned type 3002 private lines in accordance with F.C.C. tariff 260. The five store-and-forward centers, Los Angeles, Kansas City, Indianapolis, Washington, and Jacksonville, will send all the NAS flow control messages over the five 2400 baud channels to the CFCCC. Each of these centers has an IBM 9020D which will perform the store-and-forward operation. In addition, two centers (Salt Lake City and New York) will act as a relay between a peripheral center and a store-and-forward center. Each store-and-forward center will have two Buffered Interfacility Output adapters (BINTO) and two Buffered Interfacility Input adapters (BINTI) with the necessary modems for a single 2-way 2400 bps communication link to similar equipment at the CFCCC. Figure A-3 illustrates the interface configuraiton between a NAS store-and-forward center and the CFCCC facility.

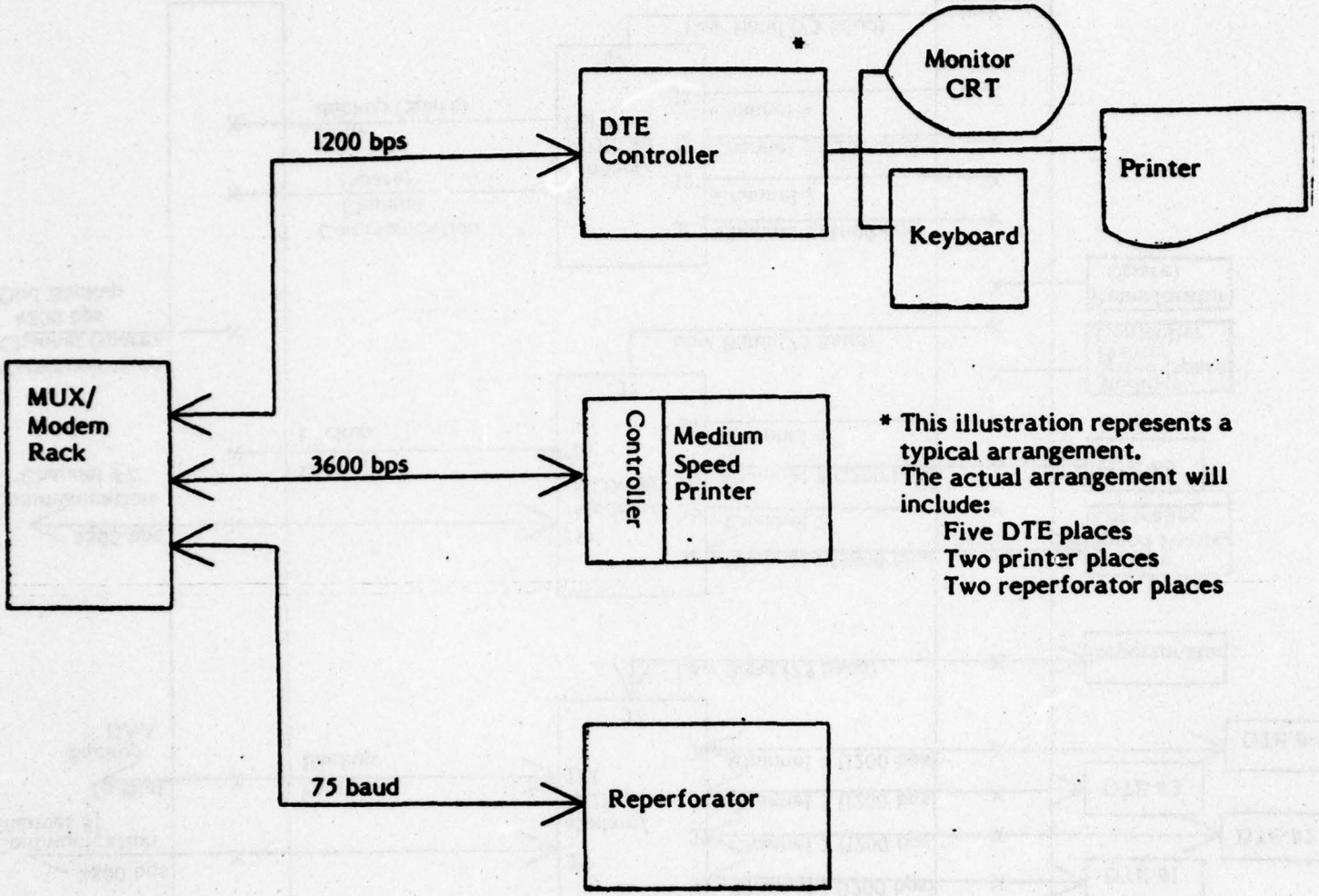


FIGURE A-2. SCC--CFCCC INTERFACE CONFIGURATION

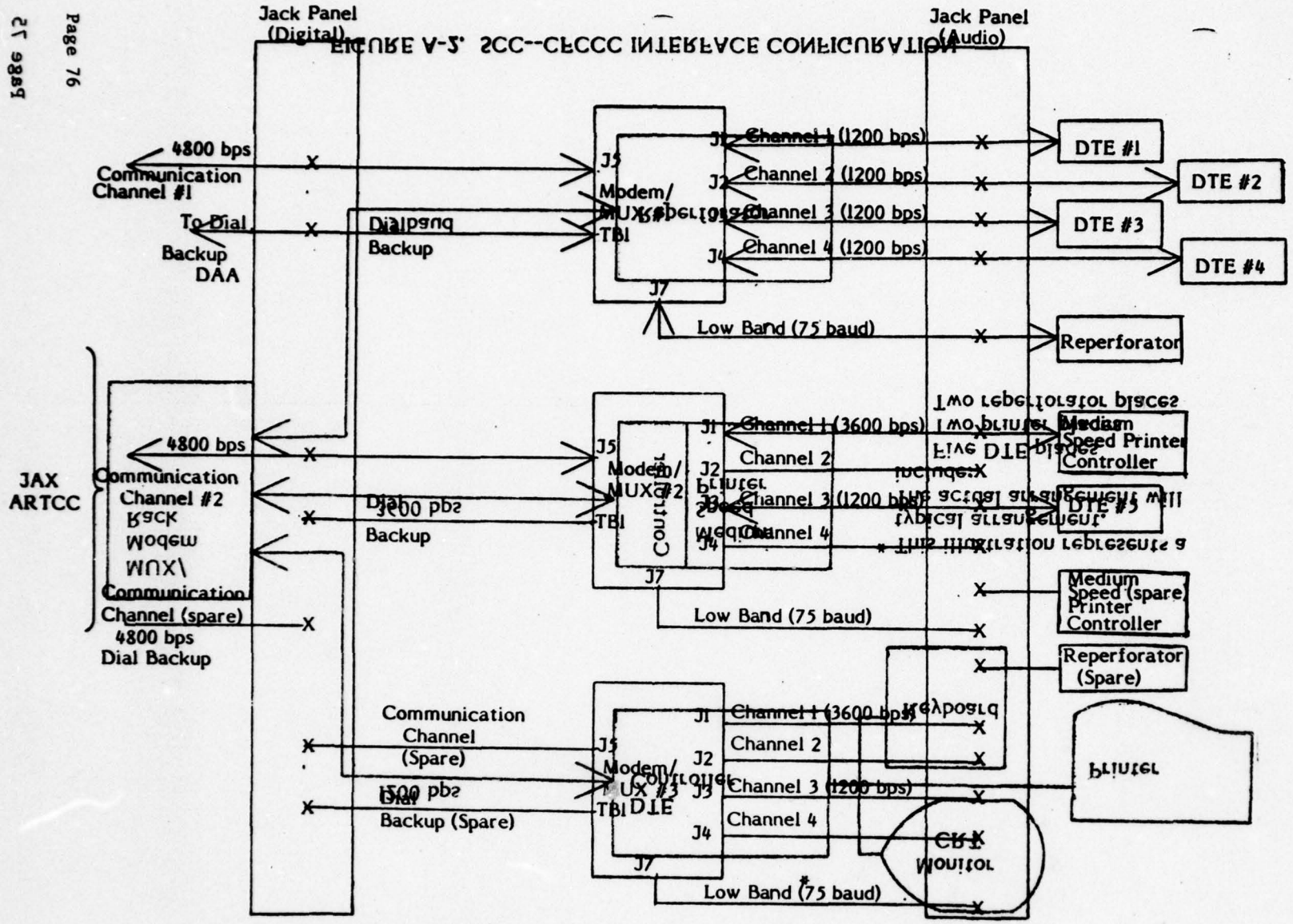


FIGURE A-2. (PART 2) COMMUNICATION RACK (SCC)

TABLE A-4

SCC-CFCCC Interface Equipment

for the

Automated Central Flow Control Function

Hardware Elements	Quantity
GPO/GPI adapter	16
TTYLL adapter	2
Modem/multiplexer - 4800 bps	6
Four channel data multiplexer	6

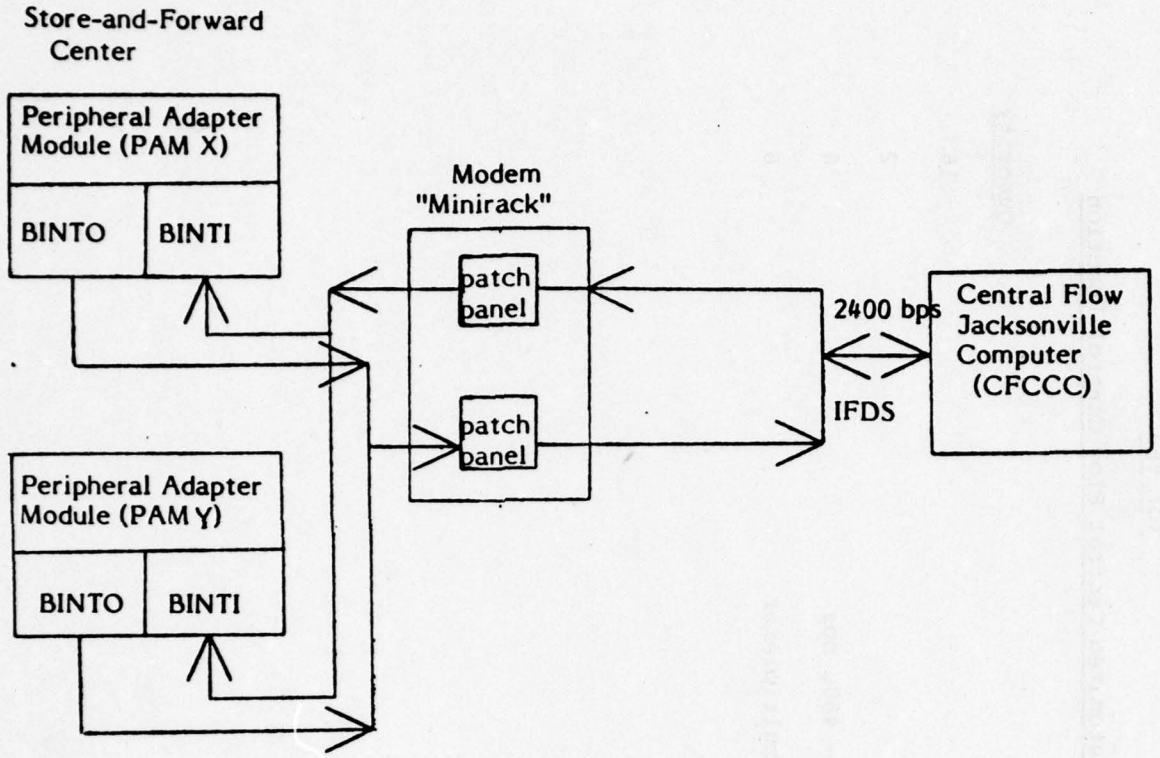


FIGURE A-3. NAS (STORE-AND-FORWARD CENTERS)--CFCCC INTERFACE CONFIGURATION

2. SYSTEM SOFTWARE.

a. Online System Software. The online system software consists of the operational messages to be transmitted between the SCC and the CFCCC and between NAS and the CFCCC. All messages belong to one of five major message categories. These categories are:

Data count.

Data list.

Simulation.

Data base update.

Acknowledgment.

A summary of all presently defined messages within the first four categories is shown in Table A-5. Data count messages, data list messages, and simulation messages are entered from a DTE central flow control console or directly into the CFCCC via NAS. Acknowledgment messages are generated for every operational message entered from either a DTE central flow control console or NAS. Abbreviated descriptions for each message follow.

(1) Data Count Messages. These messages cause the data base to be searched to provide tabulated counts of various types of data which are of use to the central flow controller. Specific messages in this category are:

(a) DEMD - Departure Demand. The departure demand message tabulates hourly counts of aircraft expected to depart a specified pacing airport or all the pacing airports within a specified ARTCC on the current day. The tabulation includes active flights as reported by NAS as well as expected departures as furnished by the OAG, NAS, and ATCSCC inputs. General aviation (GA) counts are made by choosing the larger of the actual GA count determined by GA flight plans furnished by NAS, SCC, or by applying a GA estimate stored within the data base for each pacing airport.

(b) DESD - Future Departure Demand. The future departure demand message tabulates hourly counts of aircraft expected to depart a pacing airport (or all the pacing airports within a specified ARTCC). It uses the GA estimate stored in the data base for each pacing airport or ARTCC.

TABLE A-5

CFC MESSAGE SUMMARY

DATA COUNT	DATA LIST	SIMULATION	DATA BASE UPDATE
DEMD Departure Demand	LISD List Departures	ARRD Arrival Delay Prediction	ACTV Activate Flight Plan
DEMA Arrival Demand	LISA List Arrivals	FADP Fuel Advisory Departure Block Times	INHB Inhibit Flight Plan
DESD Future Departure Demand	LIFP List Flight Plan	FADF Fuel Advisory Departure Estimated Departure Clearance Times	FPSD Add Flight Plan
DESA Future Arrival Demand	CAPL List Landing Capacities	FADT Fuel Advisory Departure Test	CXSD Delete Flight Plan
FIXL Fix Loading	GAEL List General Aviation Estimates	QFLW Quota Flow First Tier	CAPS Set Landing Capacities
DLDY Departure Delay Test		QFLZ Quota Flow by Zone	GAES Set General Aviation Estimates
			NAS Messages FP Flight Plan DM Departure RS Remove Strip

(c) DEMA - Arrival Demand. The arrival demand message tabulates hourly counts of aircraft in the same manner as the departure demand message, except that arrivals are counted. Subtotals for currently airborne aircraft are included.

(d) DESA - Future Arrival Demand. The future arrival demand message tabulates hourly counts of aircraft in the same manner as the future departure demand message, except that arrivals are counted.

(e) DLDY - Departure Delay Test. The departure delay test message applies a specified delay factor to aircraft departing a designated pacing airport and tabulates hourly counts of the resulting predicted arrival demand at another designated pacing airport.

(f) FIXL - Fix Loading. The fix loading message tabulates hourly counts of aircraft scheduled to cross a designated fix(es). In addition to the total count, the message response includes a separate count for active flights which are airborne.

(2) Data List Messages. These messages cause the data base to be searched for specific data elements which are then listed. Specific messages in this category are:

(a) CAPL - List Landing Capacities. The list landing capacities message lists the normal and current day's landing capacity values in hourly increments for a specified pacing airport or for all pacing airports.

(b) GARL - List General Aviation Estimates. The list general aviation estimates message lists the normal and current day's GA estimate values in hourly increments for a specified pacing airport or for all pacing airports within a specified ARTCC.

(c) LIFP - List Flight Plan. The list flight plan message lists the active flight records, which include aircraft ID, departure airport, proposed gate time of departure, arrival airport, proposed gate time of arrival, and type of aircraft for a specified aircraft's identification involving a specified pacing airport. An aircraft flying to several pacing airports will have a flight plan record for each leg of the flight.

(d) LISA - List Arrival. The list arrival message lists information (data in the flight record, plus the departure ARTCC and the estimated time en route) on planned arriving aircraft at one or all pacing airports within a specified ARTCC. The list is sorted in ascending order by proposed time of arrival.

(e) LISD - List Departure. The list departure message is identical to the list arrival message except that departures are listed in addition to the arrivals. The list is sorted by proposed gate time of departure in ascending order.

(3) Simulation Messages. These messages generate computer simulations which result in delay and/or capacity predictions to be computed and tabulated. Specific messages in this category are:

(a) ARRD - Arrival Delay Prediction. The arrival delay prediction message initiates a computation of anticipated arrival delays in hourly increments at a specified pacing airport while maintaining the scheduled flight sequence. Each flight record for an arrival to the specified pacing airport has applied to it a GA estimate (from the static data base) and a stack size/time criteria to establish a predicted time of arrival. Output data identifies currently airborne flights, average and peak delays and counts of holding aircraft (average and peak).

(b) QFLW - Quota Flow First Tier. The quota flow first tier message generates a report which attempts to equalize the load on a pacing airport's airspace by releasing inbound flights on a first-in-first-out basis from first tier ARTCCs which are adjacent to the ARTCC in which the pacing airport is located. The number of aircraft allocated by the quota flow simulation for release by each tier ARTCC is tabulated in hourly increments for the current hour and the next two hours together with the number of aircraft to be carried over from one hour to the next. Quota flow is flow control based on saturating airspace consistent with maximum hold time and stack size entered by the central flow controller as part of the message input. As such, quota flow applies a constant pressure, and therefore a continuous flow of aircraft to the runway.

(c) QFLZ - Quota Flow by Zone. The quota flow by zone message is the same as the quota flow first tier message, except that an additional output is provided which breaks down the number of aircraft each first tier ARTCC can release to the impacted ARTCC into counts by individual origin ARTCC.

(d) FADP - Fuel Advisory Departure Block Time. The fuel advisory departure block time message generates several reports. The first lists landing capacities in hourly increments (same as CAPL message). The second report lists GA estimates for a specified pacing airport in hourly increments (same as GAEL messages). If the FADP input contains a zone qualifier, a QFLW message output is generated for the specified pacing airport utilizing the flow controller's stack size/ time and hold time criteria. The next part of the FADP output lists arrival delay predictions (same as ARRD message) in hourly increments for the specified pacing airport. The final FADP output lists assigned delay times in 15 minute increments for a specified or implied time range. These delay times are broken down in terms of an average delay on the ground and an average delay in a stack. The combined average delay is also part of the output. The FAD flow control strategy is to limit airborne holding to a reasonable maximum time limit. Thus, FAD does not saturate airspace but detains aircraft on the ground until the system can absorb them. The goal of FAD is the reduction of engine running time and the conservation of aviation fuel.

(e) FADF - Fuel Advisory Departure Individual Estimated Departure Clearance Times. The fuel advisory departure individual EDCT message is identical to the FADP message except for the last portion of the output. That is, FADF contains CAPL, GAEL, ARRD, and QFLW output as does FADP. The last portion of FADF output contains the assigned delay time for each individual flight in addition to that flight's departure airport, estimated departure clearance time, proposed gate time of departure, ground assigned delay, total delay, estimated time en route, new estimated time of arrival, and arrival ARTCC boundary crossing time. The FADF message is useful in determining the arrival sequence by aircraft identification at the impacted airport.

(f) FADT - Fuel Advisory Departure Test. The fuel advisory departure test message inititates a simulation using test values that results in a calculation of expected arrival times at the destination airport. This message is used as a prelude to determine whether FADP or FADF procedures are required. The series of output produced by FADT is similar to FADP and includes the output produced by QFLW and ARRD but not those produced by the CAPL and GAEL messages.

(4) Data Base Update Messages. These messages are used to change or augment the data base. Specific messages in this category are:

(a) ACTV - Activate Inhibited Processing. The activate inhibited processing message restores a specified airline or individual flight back to the active data base so that it can be subsequently retrieved on demand. The restoration is effective on the day specified by the message and all subsequent days through the time period covered by the OAG data base.

(b) INHB - Inhibit Processing. The inhibit processing message blocks a specified airline or individual flight from retrieval from the data base effective the day specified by the message and all subsequent days through the time period covered by the OAG data base.

(c) FPSD - Add Flight Plan. The add flight plan message provides the capability to enter a flight plan for an air carrier into the OAG data base.

(d) CXSD - Delete Flight Plan. The delete flight plan message provides the capability to eliminate, for a single day, a flight plan for an air carrier from the OAG data base.

(e) CAPS - Site Landing Capacities. The site landing capacities message causes the entered landing capacities for the specified pacing airport during the specified time range to be stored in the data base for the current day, replacing any values previously entered automatically (at startup) or via a DTE flow control console.

(f) GAES - Set General Aviation Estimates. The set general aviation estimates message causes the entered GA estimates for the specified pacing airport during the specified time range to be stored in the data base for the current day, replacing any values previously entered automatically (at startup) or via a DTE central flow control console. The following data base update messages are relayed by the NAS en route stage A system to the CFCCC:

1 FP - Flight Plan. The flight plan message forwards to the CFCCC a flight plan record for each noncarrier flight that plans to land at a pacing airport when received from one of the 20 ARTCCs. This information is added to the data base and is available for retrieval, data counting, data listing, and simulations.

2 DM - Departure. The departure message forwards to the CFCCC the actual departure time for each departure aircraft going to a pacing airport and inserts this time into the aircraft's flight plan record.

3 RS - Remove Strip. The remove strip message removes the flight plan record from the data base for any proposed departure flight that had intended to land at a pacing airport but has canceled the flight or has diverted to a nonpacing airport.

(5) Acknowledgment Messages. Each operational central flow control message entered from a DTE central flow control console will generate a response from the CFCCC that will be displayed on the console's readout device. The responses consist of an "ACCEPT" message, a "REJECT" message (CFCCC does not accept a message due to computer error, incomplete transmission, etc.) or an error message (message is acknowledged but not accepted because of format error). The edit for error checks for valid values in the message fields. Each central flow control message entered from NAS will generate a transmission accepted (TA) or transmission rejected (TR) message which is transmitted to the sender.

b. Offline System Software. The offline system software functions are composed of six groups - utilities, data reduction and analysis (DR&A), static data base, system build, system test, and management aids.

(1) Utilities. The utilities group includes the operating system (OS/9020 - MVT), the compiler, the assembler, and additional processors which are required to facilitate the production, management, and maintenance of programs and data for both the operational and support systems.

(a) The OS control programs have three major functions: job management, data management, and task management. Job management involves processing communications between the programer and operator to the control program. Data management includes allocating space on direct access volumes, storing, naming, and cataloging data sets, and scheduling I/O operations. Task management includes the following: overlapping CPU operation with I/O channel activity, servicing hardware interrupts, handling supervisor calls, allocating main storage, dynamic loading of programs not in main storage, synchronous overlay supervision, recording machine malfunctions, and servicing requests for checkpoint records.

(b) The JOVIAL compiler translates source code into basic assembly language (BAL) code for assembler processing. The assembler translates BAL input into loadable object modules.

(c) The library edit creates a disk resident library of common subroutines and procedures.

(d) The JOVIAL structured program testing formatter provides indentation of JOVIAL source code to conform to structured programing listings. The JOVIAL source processor provides the capability to include JOVIAL source statements from other sequential or partitioned data sets into a data set for input to the JOVIAL compiler.

(e) A JOVIAL library will be provided by the offline systems. The OS/9020A JOVIAL and linkage editor access a disk resident library generated by the OS version of the library edit program. The library routines include mathematical, data conversion and movement, data comparison, input/output, unit positioning, and initialization routines.

(f) Conversational remote job entry (CRJE) enables users at remote keyboard terminals to access the 9020A. Jobs submitted under this capability are scheduled, initiated, executed, and terminated under control of the OS job management routines giving the remote user the same batch computing facility that is available to a local user.

(g) The Houston automatic spooling program (HASP), operating in conjunction with OS/9020A, performs peripheral functions not normally accomplished by the operating system. HASP controls job flow, the ordering of tasks, and spooling input and output (stealing small amounts of CPU time to operate the printer and reader/punch while directly communicating with OS).

(2) Data Reduction and Analysis (DR&A). The DR&A routines provide the capability to reduce and analyze data recorded during live operation. Comprehensive listings, summaries, and statistical reports are produced to enable evaluation of past performance. The reports include:

Input/output log (IOLOG).

Data base analysis (DBA).

Input/output message summary (IOSUM).

Response time summary (RTSUM).

Log comparison function (LOGCOMP).

Performance and activity measures (PMAM).

General recording data processor (GRDP).

A brief description of each follows:

(a) IOLOG. Provides a listing of all input/output messages recorded on tape during CFC operations. The message type, source and destination identity, and time are determined, when possible, interpreted into more meaningful information and displayed in a legible output format. IOLOG is also able to filter and sort data according to user selected parameters which include start/stop time, message type, source, destination, and airport center ID.

(b) DBA. Provides the capability to recreate all dynamic tables at any desired point in time. The tables will be reconstructed from the data recorded online and from messages that would affect changes to these tables. After the tables have been recreated, the user has the option to obtain complete or selective listings of the data.

(c) IOSUM. Summarizes all or selected I/O messages to and from the operational CFC system. Reports are produced in a legible format displaying summaries and statistical information on the volume and distribution of I/O messages. The summaries can be filtered and sorted with respect to the same parameters as the IOLOG function.

(d) RTSUM. Calculates and produces summary reports on the amount of time required by the CFCCC to produce an output message in response to an input message. RTSUM uses the IOLOG function as a basis for the analysis. Only successful attempts to correlate I/O messages will be used to compute response time statistics such as: mean, maximum, minimum, standard deviation, and frequency distribution. The user can break down the statistics by message type, source, and time intervals.

(e) LOGCOMP. Compares two sorted and edited on-line recorded tapes and provides a formatted and legible output listing which notes any discrepancies in the records of the two compared tapes. Tape records can be selected by specifying time intervals, record types, message types, and/or message source/destination.

(f) PMAM. Provides the means for analyzing the operational system hardware and software performance from the view point of timing, utilization, and workload of the various system components. Some of the measures to be provided include utilization of each CE, SE, IOCE, I/O device, etc; utilization and frequency of use of major CFC subprograms; summary of issued I/O, external and supervisor call interrupts; queuing statistics or major system queues; sizing reports on dynamic buffers in main memory; sizing reports on storage areas on tape and disk.

(g) GRDP. Provides a general purpose data reduction capability according to user requirements of which data records are to be processed. The program has the ability to process all types of records encountered in the online recorded data. Diagnostic messages are provided for any unprocessed data blocks.

(3) Static Data Base Group. These routines assemble the static data base and the adaption data that are used online by the CFC system. The two programs comprising this group are the static data base assembler (SDBA) and the system adaption data assembler (SADA).

(a) The SDBA is an offline program which generates and updates the various CFC static data base files accessed during online operations. The SDBA handles such data as air carrier flight schedules, airport data, airline codes, aircraft types, ARTCC data, zone data, GA data. The primary input to the SDBA are the OAG data tapes supplied by the Donnelley Corporation. In addition, required data is input through tapes or cards. Processing is determined through user control cards specifying the required SDBA function and the run parameters. SDBA edits the input data and insures the validity and completeness of the new files and notifies the user of any errors.

(b) The SADA adapts the CFC to system configuration requirements. The user specifies the environment under which CFC will operate. SADA processes this input data, checks it, and produces a system adaption data base. This data base is in object module form and is readily available to be used by the system build processors to generate the operational online CFC system. SADA also provides the capability to modify and update an existing adaption data base. As an option, SADA provides various output listings with user oriented information. Adaption data consists of geographic data (airports, ARTCCs, fixes, airways, and zone structure), communication data (line connections, line characteristics, buffer storage, number of retransmission and I/O devices), and monitor data (online recorded data, recovery recordings, program priorities, timing data, logical device numbers, output message routing, security locks and authorized passwords and startup/startover tasks).

(4) System Build Group. This group provides the capability to generate and maintain an initial program loadable (IPL) disk resident CFC system. User options permit the selection of hardware, software, storage areas, and the overall system environment. Required input includes data sets on tape or disk containing the CFC operational programs in object form, system library routines, adaption file, user parameters, and static data base file. The functions of the program are to construct and write a disk IPL record, read and transfer onto disk the core-resident and disk-resident data sets in core image form, allocate disk space for recovery recording data, construct necessary linkages between program and storage areas and between programs and hardware devices, and set storage protect keys. As an option, a system build run can produce printouts describing the newly built system configuration, cross-reference listings and statistical data. A system update capability is also provided to facilitate an efficient updating of the disk-resident system and data base. In addition, an offline program is provided to create transportable and backup copies of the disk resident system. The system can thus be "dumped" on magnetic tape or disk and subsequently "restored" on a disk which can be used to IPL an operational system.

(5) System Test Group. These routines facilitate program testing, evaluation, and shakedown. Additional functions include training and demonstration.

(a) The routines simulate the operation of the CFC system in a controlled environment without the need for actual data, flight plans, site communications, controllers, etc. Test drivers generate simulated input which would normally be sent to the CFCCC facility and the communication interfaces between CFCCC and SCC and between CFCCC and NAS.

(b) The user of this function is provided with the capability to produce offline any desired scenario for subsequent testing on the CFC system. In addition, simulated events can be provided online during a system test run.

(6) Management Aids Group. Management aids routines available in the offline system are program evaluation review technique (PERT), a program analyzer, hierarchy input process output (HIPO), and an automated code auditor.

(a) PERT is a tool which helps in visualizing the progress of the individual project activities from proposal to completion. Continued use of PERT throughout the project will inform management of current or potential future problems which could impact the projected completion date of either the project as a whole or its activities.

(b) The program analyzer is intended to reduce the cost of assuring that software systems written in JOVIAL are comprehensively tested. The analyzer will be applied during program testing to aid in the exercising of untested program paths and identifying test cases appropriate to the improvement of testing coverage. These features are provided by analysis of program structure, instrumentation of the system through insertion of appropriate software probes to measure testing coverage and production of comprehensive reports that pinpoint paths in the program structure that remain to be exercised. Guidance is provided for the generation of test cases which will assure coverage of the untested portions. This function can be thought of as a partner during the testing process, supplying a wide variety of automated aids to the user in comprehensive testing activities.

(c) HIPO is a design aid and documentation technique. It describes the function of a system from the general to the detail level, providing a logical extension of a top-down development effort. It graphically shows what a system or program does and indicates what data has been used and created. In conjunction with the CFC development effort, a complete set of HIPO documentation and diagrams will be assembled and maintained as part of the CFC support library. As CFC operational programs are updated and incorporated within the system build assembly, the appropriate HIPO diagrams will be concurrently updated. This will insure that current documentation is maintained. It will also help to reduce the possibility of discrepancies between interfacing modules caused by failure to coordinate changes involving several program modules.

(d) The automated code auditor (ACA) is a management aid which assists in the large scale checkout of computer code. In a system such as central flow control, where thousands of lines of computer code exist, there is a gap between achieving diagnostic free compilation and operationally acceptable programs. This results in situations where large amounts of code are never exercised by the program as well as code whose only purpose is to correct errors produced by other code. The ACA is designed to flag these types of items. ACA is a disk resident program which will test subprograms as units and strings as well as testing the total program. This will result in an appreciable variation in the offline system resources required for any specific run of the program. No direct interface with the online system is required; however, some elements of the online system, such as the compool, will be used for the ACA.

APPENDIX 2. DEFINITION AND DIRECTIVES

1. GLOSSARY.

AAF	Airway Facilities Service
AAT	Air Traffic Service
ABU	Aviation Office of Budget
ACA	Automated Code Auditor
ACTV	Activate Flight Plan Message
AIRS	Airport Information Retrieval System
ALG	Logistics Service
APT	Office of Personnel and Training
ARB	Agency Review Board
ARD	Systems Research and Development Service
ARINC	Airline Radio INC
ARRD	Arrival Delay Prediction Message
ARTCC	Air Route Traffic Control Center
ASCII	American Standard Code for Information Interchange
ASP	Office of Aviation Systems Plans
ATC	Air Traffic Control
ATCSCC	Air Traffic Control System Command Center
ATS	Air Traffic Service
AVP	Office of Aviation Policy
BAL	Basic Assembly Language
BINTO	Buffered Interfacility Output
BINTI	Buffered Interfacility Input
BPS	Bits Per Second
CAPS	Set Landing Capacity Message
CAPL	List Landing Capacity Message
CCC	Central Computer Complex
CCD	Configuration Control Decision
*	Configuration Change Proposal
CFC	Central Flow Control
CFCF	Central Flow Control Function
CFCS	Central Flow Control System
CFCCC	Central Flow Control Computer Complex
CID	Configuration Identification Documentation
CMS	Configuration Management Staff
CO	Contracting Officer
COR	Contracting Officer's Representative
CPFS	Computer Program Functional Specifications
CPU	Central Processing Unit
CRJE	Conversational Remote Job Entry
CRT	Cathode Ray Tube
CXSD	Delete Flight Plan Message

*Should use NCP - NAS Change Proposal in lieu of this term

DA	Transmission Accepted
DAA	Data Access Arrangement
DBA	Data Base Analysis
DDD	Direct Distance Dial
DEC	Digital Equipment Corporation
DEMA	Arrival Demand Message
DEMD	Departure Demand Message
DESA	Future Arrival Demand Message
DESD	Future Departure Demand Message
DLDY	Departure Delay Test Message
DM	Departure Message
DOD	Department of Defense
DR	Transmission Rejected
DR&A	Data Reduction & Analysis
DTE	Data Terminal Equipment
EC	Engineering Change
EEM	Electronic Equipment Modification
F&E	Facilities and Equipment
FAA-HQ	Federal Aviation Administration-Headquarters
FAD	Fuel Advisory Departure
FADF	Fuel Advisory Departure Estimated Departure Clearance Times Message
FADP	Fuel Advisory Departure Block Times Message
FADT	Fuel Advisory Departure Test Message
FAR	Federal Aviation Regulation
FIG	Facilities Integration Group
FIXL	Fix Loading Message
FOB	Federal Office Building
FP	Flight Plan Message
FPSP	Add Flight Plan Message
FY	Fiscal Year
GAEL	List General Aviation Estimates Message
GAES	Set General Aviation Estimates Message
GFE	Government Furnished Equipment
GPI	General Purpose Input
GPO	General Purpose Output
GRDP	General Recording Data Processor
GSA	General Services Administration
HASP	Houston Automatic Spooling Program
HIPO	Hierarchy Input Process Output
IBM	International Business Machines
IFDS	Interfacility Data Set
INHB	Inhibit Flight Plan Message
I/O	Input/Output

IOC	Initial Operating Capability
IOLOG	Input/Output Log
IOSUM	Input/Output Message Summary
IPL	Initial Program Loadable/Load
ISSAC	Initial Supply Support Allowance Charts
JAI	Joint Acceptance Inspection
JAX	Jacksonville ARTCC
JOVIAL	Jules Own Version of Integrated Assembly Language
LISA	List Arrivals Message
LISD	List Departures Message
LIFP	List Flight Plan Message
LLTIL	Long Lead Time Items List
LOGCOMP	Log Comparison Function
MTBF	Mean Time Between Failure
MODEM	Modulator/Demodulator
MUX	Multiplexor
NAFEC	National Aviation Facilities Experimental Center
NAS	National Airspace System
NASPO	National Airspace System Program Office
NPL	Numerical Parts List
OAG	Official Airline Guide
OER	Onsite Engineering Representative
ORD	Operational Readiness Demonstration
OS	Operating System
PAM	Peripheral Adapter Module
PERT	Program Evaluation Review Technique
PMAM	Performance and Activity Measures
PPL	Provisioning Parts List
QFLW	Quota Flow First Tier Message
QFLZ	Quota Flow by Zone Message
ROE	Regional Onsite Coordinator
RS	Remove Strip Message
RTSUM	Response Time Summary
SADA	System Adaption Data Assembler
SCC	System Command Center
SDBA	Static Data Base Assembler
SIP	Site Implementation Plan
SOST	Site Operational System Test

SRDS	System Research and Development Service
TO	Technical Officer
TTY	Teletypewriter Equipment

2. DEFINITION OF TERMS.

Backup	A subsystem or module that is not presently being used to perform a useful function but that can readily replace active equipment in the event of a failure.
Baseline	The standard configuration on which the system is based. It assures commonality and compatibility of like systems from facility-to-facility.
Configuration Control	The systematic evaluation, coordination, approval, or disapproval of all changes to a baseline configuration.
Hardware	Equipment.
Initial Operating Capability	The time that the responsible personnel have completed installation and checkout of a system, site adaption of the software, and integration of the operational software with the total hardware system.
Offline Operation	A computer operation which is independent of the time base of the actual input.
Online	Under control of a central computer.
Online Diagnostics	Running diagnostics on a system while it is online but off-peak to save time and to take corrective action without closing down the system.
Operations Changeover	The phase of implementation when a system is phased into daily ongoing operations.

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ENGINEERING AND DEVELOPMENT PROGRAM PLAN - CENTRAL FLOW CONTROL--ETC(U)
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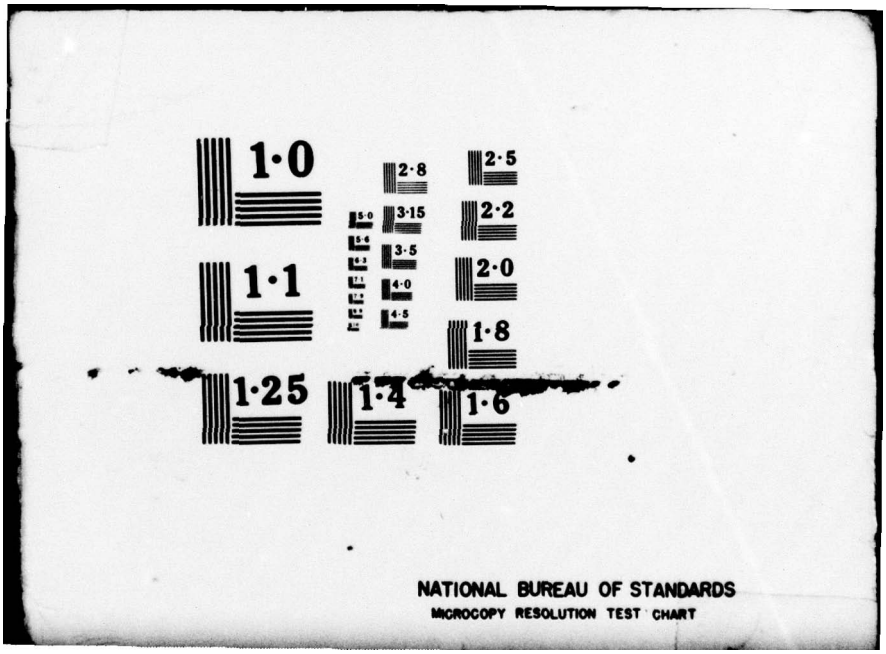
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NATIONAL BUREAU OF STANDARDS
MICROCOPY RESOLUTION TEST CHART

Pacing Airports	Airports selected on the basis of generating the preponderance of air traffic delays within the ATC system.
Program Plan	This document, designed to provide overall management direction for implementing the central flow control automation program.
Simulation	The representation of physical systems and phenomena by computers.
Software	A Computer program.
System Shakedown	A phase in which personnel are familiarized with the integrated hardware and software of a system.

3. HANDBOOK AND ORDER REFERENCE.

a. Handbooks.

1100.1, FAA Organization - Policies and Standards

1100.2, FAA Organization - FAA Headquarters

1800.1, National Airspace System Management Handbook

1800.8, Systems Maintenance Service Planning, Programming, and Budgeting Procedures - Internal

33350.2, Staffing Adjustments

4250.9, Field Inventory Management and Replenishment

4650.2, Facility Equipment Records

4660.1, Real Property

4650.7, Management of Project Material

4800.2, Utilization and Disposal of Excess and Surplus Personal Property

b. Orders.

1100.121A, Management of ATC Automation Systems

1100.127A, Airway Facilities Sector Configuration

1100.134A, Maintenance of National Airspace System Automation Systems

1320.37, Contractor Developed Equipment Instruction Books

1600.2A, Classification, Reclassification and Control of National Security Information

1750.6, National Airspace System Documentation Facility

1800.8D, National Airspace System Configuration Management

1800.30, Development of Logistic Support for FAA Facilities and Equipment

2500.10H, Call for Estimates - General Information and Policies

2510.5, Fiscal Programming and Reporting Procedures for the Facilities and Equipment Appropriation

2700.13, Financial Reporting Procedures for NASPO

4560.1, Initial Provisioning for Support of Facilities

4620.1, Scheduled Overhaul of Ground Facilities Equipment

4620.3B, Initial Support for New or Modified Equipment

4630.2, Standard Allowances of Supplies and Working Equipment for National Airspace Facilities

4650.17A, Guide for Non-FAA Activities which Receive Supply Support and Service from the FAA Aeronautical Center (FAA Depot)

6000.19, Use of Specifications FAA D 2494/1 and 2494/2 Instruction Book Manuscript Technical: Equipment and Systems Requirements

6200.4A, Test Equipment Management

7210.76, Flow Control Procedures

c. Specifications.

FAA-G-1210C, Guide for Range of Provisioning Technical Documentation Required for the Initial Provisioning Process